SUBCOURSE
AV 0663

EDITION
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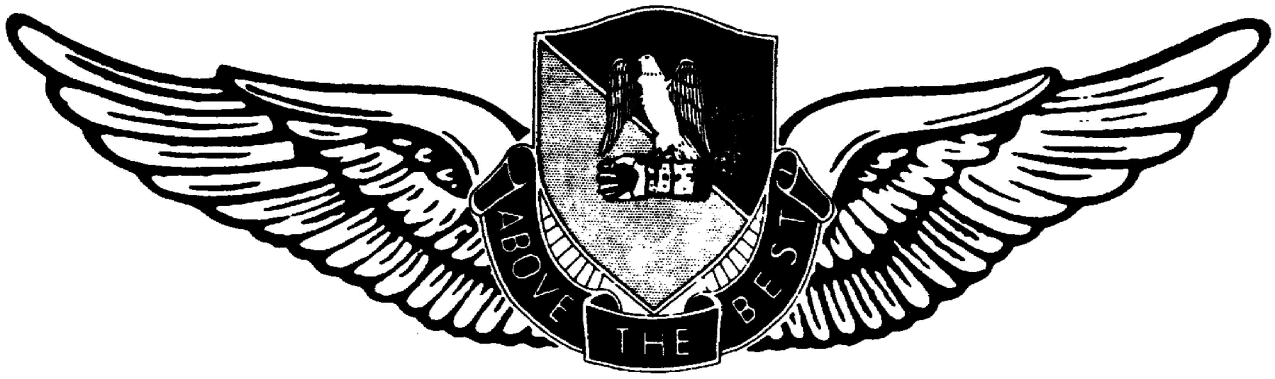

AVIATION SURVIVAL
PART III - SUSTENANCE

THIS SUBCOURSE HAS BEEN REVIEWED FOR OPERATIONS SECURITY CONSIDERATIONS.

THE ARMY INSTITUTE FOR PROFESSIONAL DEVELOPMENT
ARMY CORRESPONDENCE COURSE PROGRAM

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AVIATION SUBCOURSE 0663

AVIATION SURVIVAL

PART III. SUSTENANCE

CONTENTS

INSTRUCTIONS TO STUDENTS

NOTE

This subcourse is the third part of a four-part series. Part I, Survival Elements, Psychological Aspects, and Survival Medicine (AV 661), must be taken before attempting Parts II, Personal Protection (AV 662); III, Sustenance (AV 663); and IV, Direction Finding, Signaling, and Recovery (AV 664).

This subcourse consists of one lesson, a review exercise and review exercise solutions, and an examination. A student inquiry sheet and a student survey sheet, which can be folded into preaddressed envelopes, are provided. We urge you to use them if you have a comment or question about the subcourse.

After you have studied the lesson, solve the review exercise and then compare your answers with those on the solutions page. Reread the lesson for any portion you miss.

When you have studied the entire subcourse, solved the review exercise, and checked your answers against the review exercise solutions, you will be ready to take the examination. You may use the lesson text and references when solving the examination. Follow the specific instructions that precede the examination.

This subcourse, at time of printing, conforms as closely as possible to US Army Aviation Center and Department of the Army doctrine. Therefore, you should base your solutions on the subcourse text and not on unit or individual experience.

Unless otherwise stated, whenever the masculine gender is used, both men and women are included.

INTRODUCTION

Except for the oxygen they breathe, survivors must meet their body needs through eating food and drinking water. This subcourse explores the relationship between proper nutrition and physical and mental efficiency. This knowledge will increase your chances of surviving after a crash or forced landing or being captured by the enemy.

Supplementary training material to be provided--none.

Material to be provided by the student--none.

Material to be provided by the unit or supervisor--none.

Supervision required--none.

Four credit hours are awarded for successful completion of this subcourse.

LESSON

TASK: 9103.01-0001, Apply techniques to live off the land.

OBJECTIVE: You will be able to select foods and hopefully keep your body fluids at a level that will keep you in the best possible state of health.

CONDITIONS: You may use the lesson text and references to complete the review exercise.

STANDARD: You should answer correctly at least 11 of 15 review exercise questions.

CREDIT HOURS: 3.

REFERENCES: ARs 95-17 (May 84), 350-30 (Dec. 85), and 525-90 (Nov 71, with changes 1 and 2); AFM 64-5 (Sep 85); FMs 1-302. (Sep 83, with change 1), 20-150 (Jul 73, with changes 1 through 5), and 21-76 (Mar 86); and. DOD Directive 1300.7 (Dec 84).

LESSON TEXT

1. INTRODUCTION

a. A nutritious diet is essential to your, success in overcoming a survival situation. An improper diet over a long period of time causes a loss of physical stamina, reduced mental alertness, and slow reactions and lessens resistance to illness. All of these can cost you your life in a survival environment. A knowledge of your body's nutritional requirements will assist you in selecting the best food items to supplement your rations.

b. A survival episode can last several months. The rations contained in aviation survival kits are not intended to sustain you for more than a few days. In order to maintain physical and mental stamina for extended periods of time, you must take advantage of all possible sources of food. Many of these items are not accepted in our culture as sources of nutrition. However, you must accept the fact that items other than those we are normally accustomed to eating can be equally nutritious as our regular diet. Begin mentally preparing yourself to overcome personal food prejudices so that if the time comes, you can sustain a sufficient energy level to overcome a long-term survival situation.

(1) Animal food yields the highest nutrition content per pound of any possible food source. Virtually anything that walks, crawls, creeps, swims, or flies falls in the animal category. In some parts of the world

people eat ant eggs, termites, grasshoppers, caterpillars, and spider bodies without ill effects. With few exceptions, all animals are edible; this makes them an excellent food choice for survivors who are inexperienced in distinguishing between the infinite number of edible and poisonous plants.

(2) Using plants as a source of food requires a basic knowledge of plant characteristics. Whenever the slightest doubt exists as to the edibility of plants, employ taste testing techniques to avoid the toxic effects of poisonous varieties in nature. Another problem associated with plants is the fact that in many countries vegetables are fertilized with human feces which makes them efficient vehicles for transmission of dangerous parasites. Whenever possible, try to cook your food to reduce the likelihood of becoming contaminated with parasites and their debilitating effects.

(3) Nutritious sources of food occur almost everywhere in nature. The best place to find food beyond the reaches of civilization is near some type of water source. Almost all plant and animal life forms exist in greater abundance near the water. Likely spots include ponds, lakes, marshes, sea coasts, river banks, and between the high and low tide marks. In areas with an abundant rainfall, prime food spots are the margins of natural meadows, abandoned cultivated fields, and forests and open fields.

c. An adequate intake of water is essential to survival. Depending on the climate and your activity, it's possible to live for weeks without food. Without water, however, you can expect to die within days. Even in cold climates, the body requires 2 quarts of water per day to remain efficient. In a survival environment, drinking water is rarely readily available. The successful survivor must look for water in other than the obvious places.

2. NUTRITION

Survivors and evaders expend much more energy in survival situations than they would in the course of their normal lives. Basal metabolism is the amount of energy the body expends when resting. The rate of basal metabolism varies slightly with regard to sex, age, weight, height, and race. The basic energy expended or number of calories consumed by the hour changes as a person's activity level changes. A person who is simply sitting in a warm shelter may consume anywhere from 20 to 100 calories an hour. That same person evading through thick undergrowth with a heavy pack expends a greater amount of energy. In a survival situation, proper food can make the difference between success and failure.

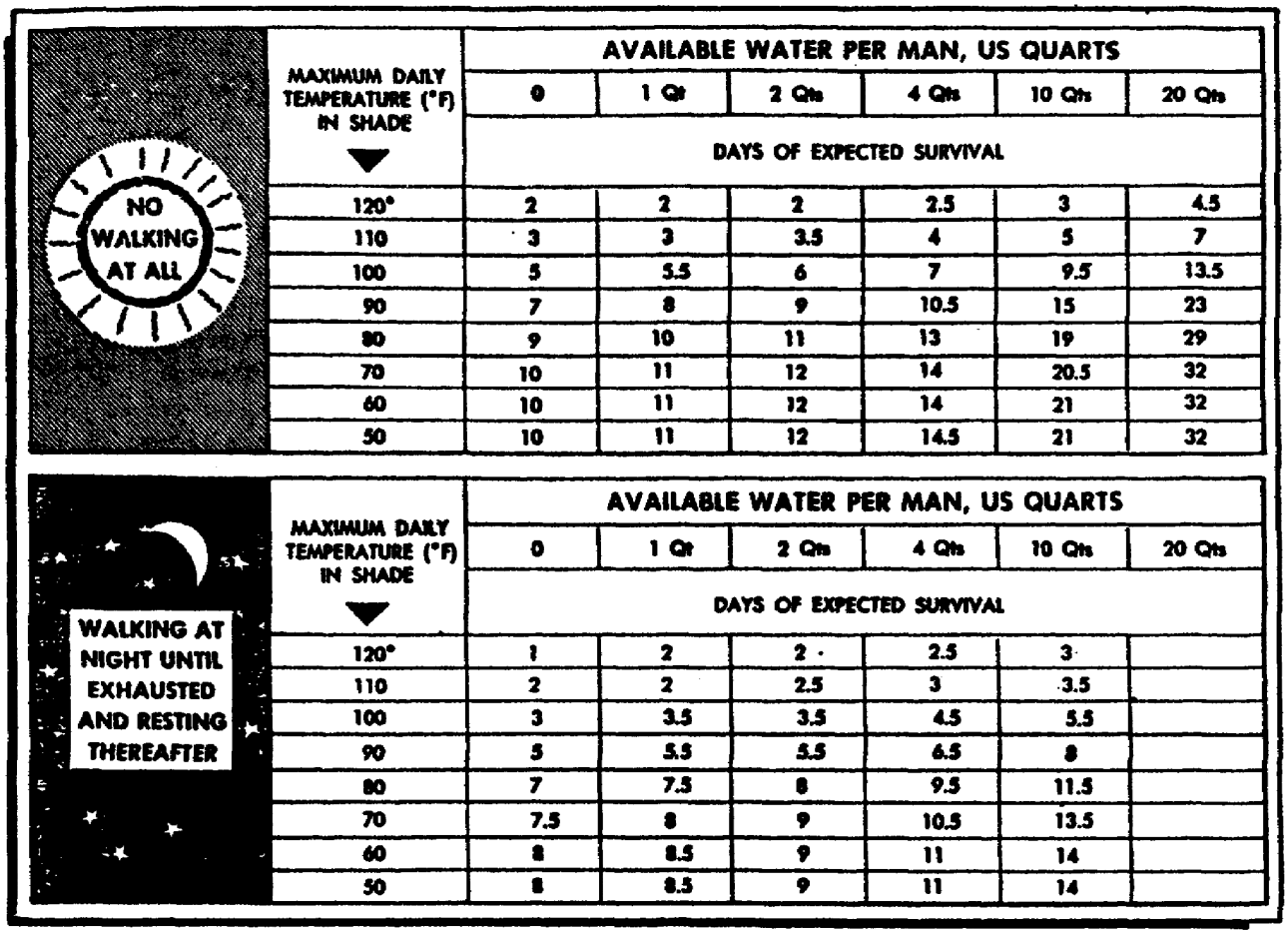


Figure 1. Water requirements.

a. The three major constituents of food are carbohydrates, fats, and proteins. Vitamins and minerals are also important as they keep certain essential body processes in good working order. You must maintain proper water and salt levels in your bodies to aid in preventing certain heat disorders.

(1) Carbohydrates. Carbohydrates are composed of very simple molecules that are easily digested. Carbohydrates lose little of their energy to the process of digestion and are, therefore, efficient energy suppliers. Because carbohydrates supply easily used energy, many nutritionists recommend that, if possible, survivors should try to use them for up to half of their calorie intake. Carbohydrates include starches, sugars, and cellulose. These can be found in fruits, milk, candy, legumes, baked goods, cereals, and vegetables. Cellulose cannot be digested by humans, but it does provide needed roughage for the diet.

(2) Fats. Fats are more complex than carbohydrates. The energy contained in fats is more slowly released than the energy in carbohydrates. Because of this, it is a longer lasting form of energy. Fats supply certain fat-soluble vitamins. Sources of these fats and vitamins

are cheese, oils; nuts, butter, egg yolks, margarine, and animal fats. If you eat fats before sleeping, you will sleep warmer. If fats are not included in the diet, you can become run down and irritable. This can lead to physical and psychological breakdown.

(3) Protein. The digestive process breaks protein down into various amino acids. These amino acids are formed into new body tissue protein, such as muscles. Some protein gives the body the exact amino acids required to rebuild itself. These proteins are referred to as "complete." Protein that lacks one or more of these essential amino acids is referred to as "incomplete." Incomplete protein examples are cheese, milk, legumes, and cereal grains. Incomplete protein, when eaten in combination with milk and beans, can supply an assortment of amino acids needed by the body. Some complete protein is found in fish, meat, blood, and poultry. No matter which type of protein is consumed, it contains the most complex molecules of any food type listed.

(a) If possible, consume the recommended daily allowance of 2 1/2 to 3 ounces complete protein each day. If only the incomplete protein is available, you may need to eat a combination of two, three, or even four types of food so that enough amino acids are combined to form complete protein.

(b) If amino acids are introduced into the body in great numbers and some of them are not used for rebuilding muscle, they are changed into fuel or stored in the body as fat. Because protein contains the more complex molecules, over fats or carbohydrates, they supply energy after those forms of energy have been used. A lack of protein causes malnutrition, skin and hair disorders, and muscle deterioration.

b. Vitamins occur in small quantities in many foods and are essential for normal growth and health. Their chief function is to regulate the body processes. Generally, vitamins can be placed into two groups: fat-soluble and water-soluble. The body only stores slight amounts of the water-soluble type. Often one or more of the four basic food groups (meat, fish, poultry; vegetables and fruit; grain and cereal; and milk and milk products) are not available in the form of familiar foods. Therefore, vitamin deficiencies, such as beriberi or scurvy, result. If you can overcome aversions to local foods high in vitamins, these diseases, as well as signs and symptoms, such as depression and irritability, can be warded off.

c. Adequate minerals can also be provided by a balanced diet. Minerals build and/or repair the skeletal system and regulate normal body functions. Minerals needed by the body include iron, salt, iodine, and calcium to name a few. A lack of minerals can cause problems with nerves, water retention, muscle coordination, and the ability to form or maintain healthy red blood cells.

d. Your body requires a minimum caloric intake to maintain proficiency. These amounts change because of individual differences in

weight, basal metabolism, and so forth. During warm weather you should consume anywhere from 3,000 to 5,000 calories per day. In cold weather the calorie intake should rise to 4,000 to 6,000 calories per day.

(1) When the opportunity to choose between food items presents itself, your being familiar with the caloric and fat content of basic food items will help you make more efficient nutritional choices. For instance, it takes quite a few mussels and dandelion greens to meet those requirements. Attempt to be familiar enough with foods that you can select, or find foods that provide a high caloric intake (Figure 2). The caloric and fat values in the chart, unless otherwise specified, are for raw foods. Depending on how you cook the food, the usable food value can be increased or decreased.

FOOD	CALORIES	FAT
WHOLE LARGE DUCK EGG	177	12.0
SMALL OR LARGE MOUTH BASS — 3 TO 4 OZ.	109	3.6
CLAMS — 4 TO 5 LARGE	88	.2
FRESHWATER CRAYFISH — 3 TO 4 OZ.	75	.6
EEL — 3 TO 5 OZ.	240	20.0
OCTOPUS — 3 TO 4 OZ.	76	.9
ATLANTIC SALMON — 4 OZ.	220	14.0
RAINBOW TROUT — 4 OZ.	200	11.8
BANANA — ONE SMALL	87	.3
BREADFRUIT — 3 TO 4 OZ.	105	.5
GUAVA — ONE MEDIUM	64	.7
MANGO — ONE SMALL	68	.5
WILD DUCK — 4 OZ.	230	16.0
BAKED OPOSSUM — 4 OZ.	235	10.6
WILD RABBIT — 4 OZ.	124	4.0
VENISON — 4 OZ.	128	3.1
DANDELION GREENS — ONE CUP COOKED	70	1.4
POTATO — MEDIUM	78	.2
PRICKLY PEAR — 4 OZ.	43	.2

Figure 2. Food and calorie diagram.

(2) You should also be familiar with the number of calories supplied by the food in issue rations and survival kits. You cannot

expect the prepackaged rations you may have at the beginning of the survival episode to last you more than a few days. When possible, conserve your energy to reduce your daily caloric requirements.

3. RATIONS

a. Rations placed in survival kits have been developed especially to provide some of the proper sustenance needed during survival emergencies. When eaten as directed, these rations will assist you in maintaining a sufficient level of energy for a short period of time.

b. The duration of the survival episode and the prevailing environmental conditions will affect the amount that survival rations must be supplemented with other sources. In cold climates, for example, more food is required to maintain body strength than in warm climates. Rescue may vary from a few hours to several months, depending on the environment, operational commitments, and availability of rescue resources in that area. Available food must be rationed based on the estimated time that elapses before being able to supplement issued rations with natural foods. If it is decided that some of the survivors should go for help, give each traveler twice as much food as those remaining behind require. In this way, the survivors resting at the encampment and those walking out will stay in about the same physical condition for about the same length of time.

c. If available water is less than a quart a day, avoid dry, starchy, and highly seasoned foods and meat. Keep in mind that eating increases thirst. To conserve water the best foods to eat are those with high carbohydrate content, such as hard candy and fruit. All work requires additional food and water. When working, increase your food and water consumption to maintain physical efficiency. If food is available, it is alright to nibble throughout the day. It is preferable though to have at least two meals a day, one being hot.

4. MAN AS A PREDATOR

a. To become successful in hunting, the hunter must go through a behavioral change and reorganize personal priorities. This means the one and only goal for the present is to kill an animal to eat. To kill this animal, the hunter must mentally become a predator. The hunter must be prepared to undergo stress in order to hunt down and kill an animal. Because of the type of weapons you are likely to have, it will be necessary to get very close to the animal to immobilize or kill it. This is going to require all the stealth and cunning you can muster. In addition to stealth and cunning, knowledge of the animal being hunted is very important. If in an unfamiliar area, you may learn much about the animal life of the area by studying signs, such as trails, droppings, and bedding areas. Having made a careful study of all the signs of the animal, you are in a much better position to procure it, whether electing to stalk it, trap it, snare it, or lie in wait to kill it.

(1) Trails. Establish the general characteristics of the animals. The size of the tracks give a good idea of the size of the animal. The depth of the tracks indicate the weight of the animal. Well worn trails often lead to the animal's watering place.

(2) Droppings. Animal dung can tell the hunter much. If it is still warm or slimy, it was made very recently. Droppings may indicate what the animal feeds upon. Carnivores often have hair and bone in the dung; herbivores have coarse portions of the plants they have eaten. Many animals mark their territory by urinating or scraping areas on the ground or trees. These signs could indicate good trap or ambush sites.

(3) Bedding areas. If there is a large amount of droppings scattered around the area, it could be a feeding or bedding area. Following the signs (tracks or droppings) may reveal feeding, watering, and resting areas.

b. If you elect to hunt, some basic techniques are helpful and can improve chances of success. Wild animals rely entirely on their senses for preservation. These senses are smell, vision, and hearing. Humans have lost the keenness of some of their senses like smelling and hearing. To overcome this disadvantage, they have the ability to reason. For instance, some animals have a fantastic sense of smell, but this can be overcome by approaching the quarry from a downwind direction.

(1) Techniques. At dawn and dusk diurnal and nocturnal animals are active and are either leaving or returning to their bedding areas. These are the best times to hunt. The five basic methods of hunting are—

(a) Using a stand. This is the best method for inexperienced hunters as it involves less skill. The main principle of this method is to wait in ambush along a well-used game trail until the quarry approaches within killing range. Morning and evening are usually the best times to still hunt. Take care not to disturb the area; always wait downwind. It takes patience and self-control to remain motionless for long periods of time.

(b) Regular stalking. Stalking refers to the stealthily approach toward game. This method is normally used when an animal has been sighted and the hunter proceeds to close the distance using all available cover. Quick movement is easily detected by the animal; therefore, stalking must be done slowly so that you make minimum noise. Always approach from the downwind side. Move only when the animal's head is down eating or drinking or when it is looking in another direction.

(c) Blind stalking. In blind stalking the same techniques are used as in the regular stalk. The main difference is that the hunter is stalking a position where the animal is expected to be while the animal is not in sight.

(d) Tracking. Tracking is very difficult unless conditions are ideal. This method involves reading all of the signs left behind by the animal, interpreting what the animal is doing, and determining how best to kill it. The most common signs are trails, beds, blood, tracks, urine, droppings, and feeding signs.

(e) Driving. You can scare some wild animals or drive them in a direction where there are other hunters or traps that have been set. This method is normally used where you can funnel the game. A valley or canyon is a good place to make a drive. More than one person is usually necessary to make a drive.

(f) Calling. You may call in small predators by imitating an injured animal. Ducks and geese are attracted by imitating their feeding calls. These noises are made by sucking on the hand or the lip, blowing on a blade of grass or paper, or using specially designed devices. You should not call animals unless you know what they are doing, as strange noises may spook the animal.

5. WEAPONS

It is difficult to kill animals of any size without using some type of tool or weapon. Many primitive tribes of the world are still effectively using spears, clubs, sling shots, and bows and arrows to provide food for their families. Although learning to become proficient with primitive weapons is important, it takes practice. As our technology has increased in complexity, so have our killing tools. If a firearm is available, a basic knowledge of shooting and hunting techniques is necessary. Hunt animals as though you would hunt a human adversary who could fight back. Animals are more intelligent and dangerous than most people think.

a. Firearms. In areas where enemy contact is likely, you must exercise extreme caution when using firearms to kill game. If possible, use alternate types of weapons that will not attract attention, such as spears and clubs. Other limiting factors in the use of firearms is the amount of ammunition on hand and the type of firearms used. To conserve ammunition, shoot only those animals that are stationary and within the range capabilities of the firearm. Aim shots at one of the vital areas such as the brain, spine, lungs, or heart (represented by black dots in Figure 3). A hit in one of these areas is usually fatal. A poorly aimed shot, hitting an area other than one of the vital areas, will likely result in lost animal and wasted ammunition. Do not be alarmed if after hitting a vital area the animal keeps moving. Even animals hit with well-placed shots sometimes travel short distances before dying. Wait several minutes before pursuing a fleeing animal. This helps reduce the distance the animal travels and the amount of time you must devote to finding it. If injured animals are not pursued, they are more likely to lay down and bleed to death a short distance from the area in which they were shot. Attempt to follow wounded animals by locating a blood trail. This can be a very time-consuming process. Begin tracing the animal's path at the location where it was shot. If you lose the trail, retrace your steps and begin again. When in

doubt, wounded animals usually-head downhill or toward a water source. You must always be, ready to shoot the animal again if necessary. Approach all downed animals with extreme caution. Remember--large animals can be dangerous when wounded, cornered, or with their young. Be sure the animal is dead, not just wounded, unconscious, or playing "possum." Animals usually die with their eyes open and glazed over. Always approach downed animals from the front so that you can detect any eye movement. Before handling the animal, poke it with a long sharp object to make sure it is dead.

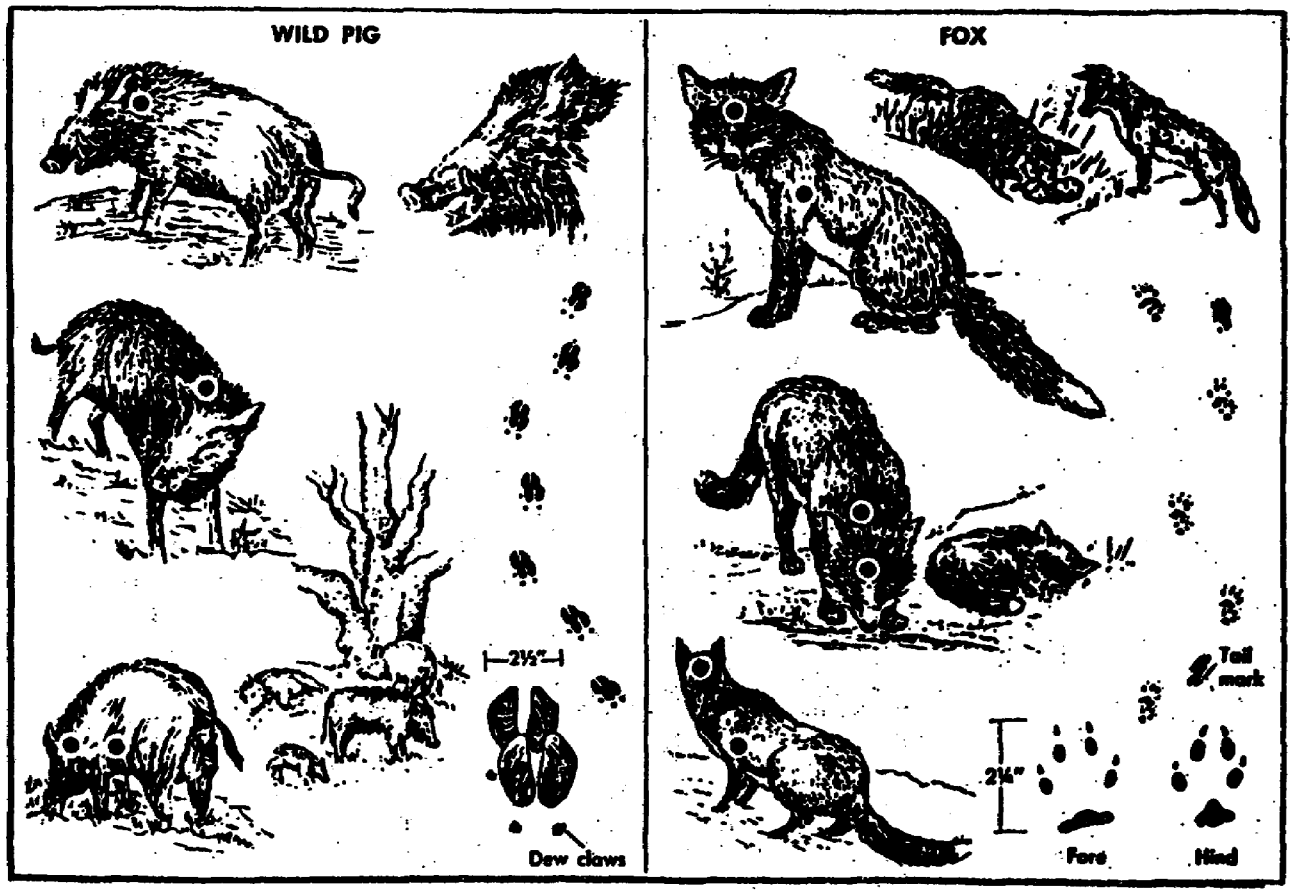


Figure 3. Shooting Game.

b. Bludgeoning Tools. Any hand held object that can be used to cast a blow falls into the category of bludgeoning tools. The most commonly recognized example of this type of weapon is the club. The effectiveness of this device is increased when the impact end is heavier than the end held in the hand. The materials used as clubs are available in your; surroundings in many forms. Many of the structural components of downed aircraft can be used as clubs. Use natural materials, such as wood and stone, to make a club as shown in Figure 4. Use this type of weapon to kill small game and for self-defense at close range. It is also desirable to use bludgeoning tools in situations where the noise of a firearm will reveal your position to the enemy.

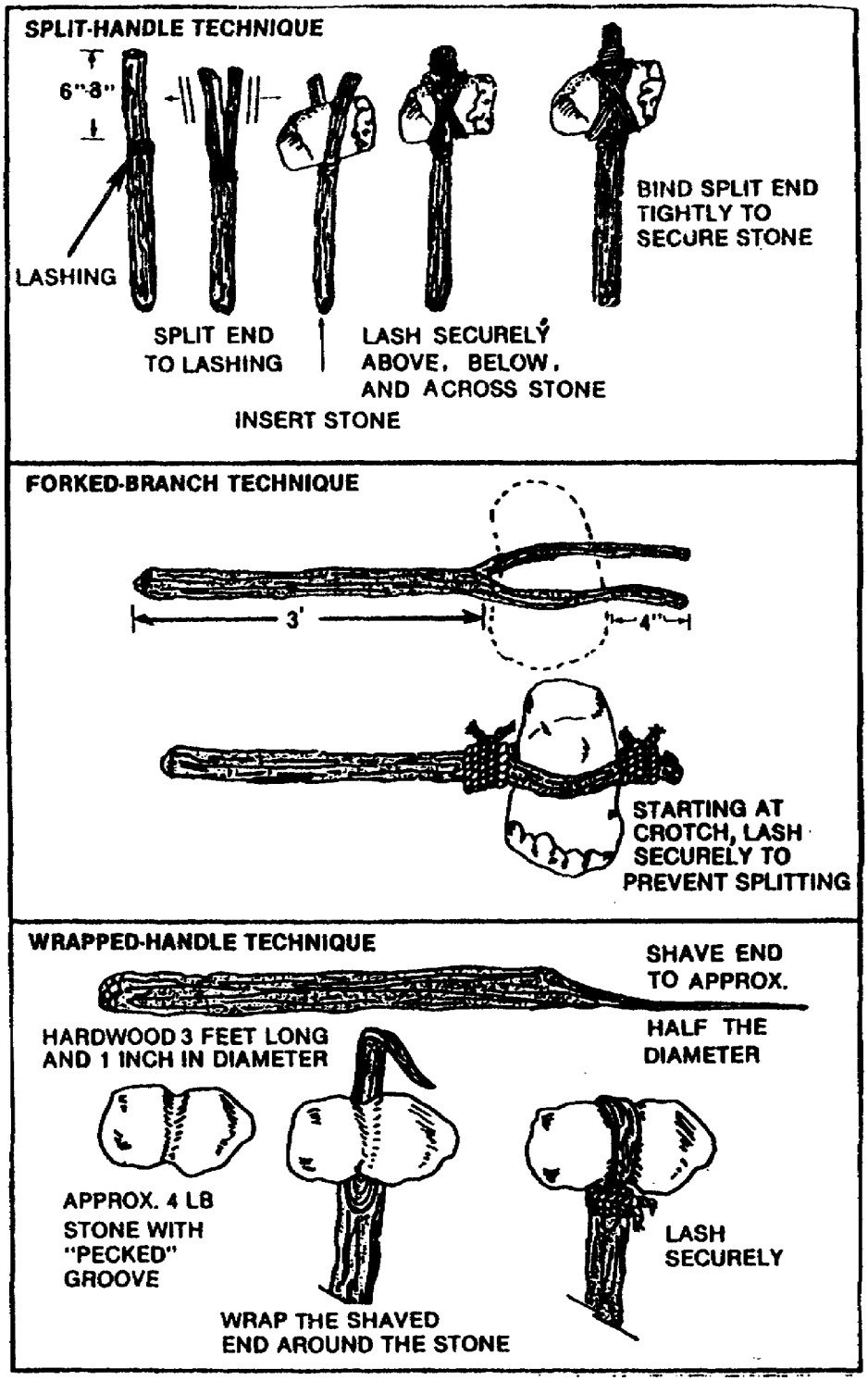


Figure 4. Lashing clubs.

c. Spears. The spear is another man-made weapon that is effective against large and small game. Small saplings are ideal for making spear handles. Select a straight sapling that is 4 to 5 feet long. Be sure that its length and weight lends itself easily to carrying and throwing. Fashion a point by sharpening one end. Harden the point by charing it

slightly in a fire. Blades for spears as well as knives can be shaped from a wide variety of materials, such as stone, bone, antler, and scrap metal (Figure 5).

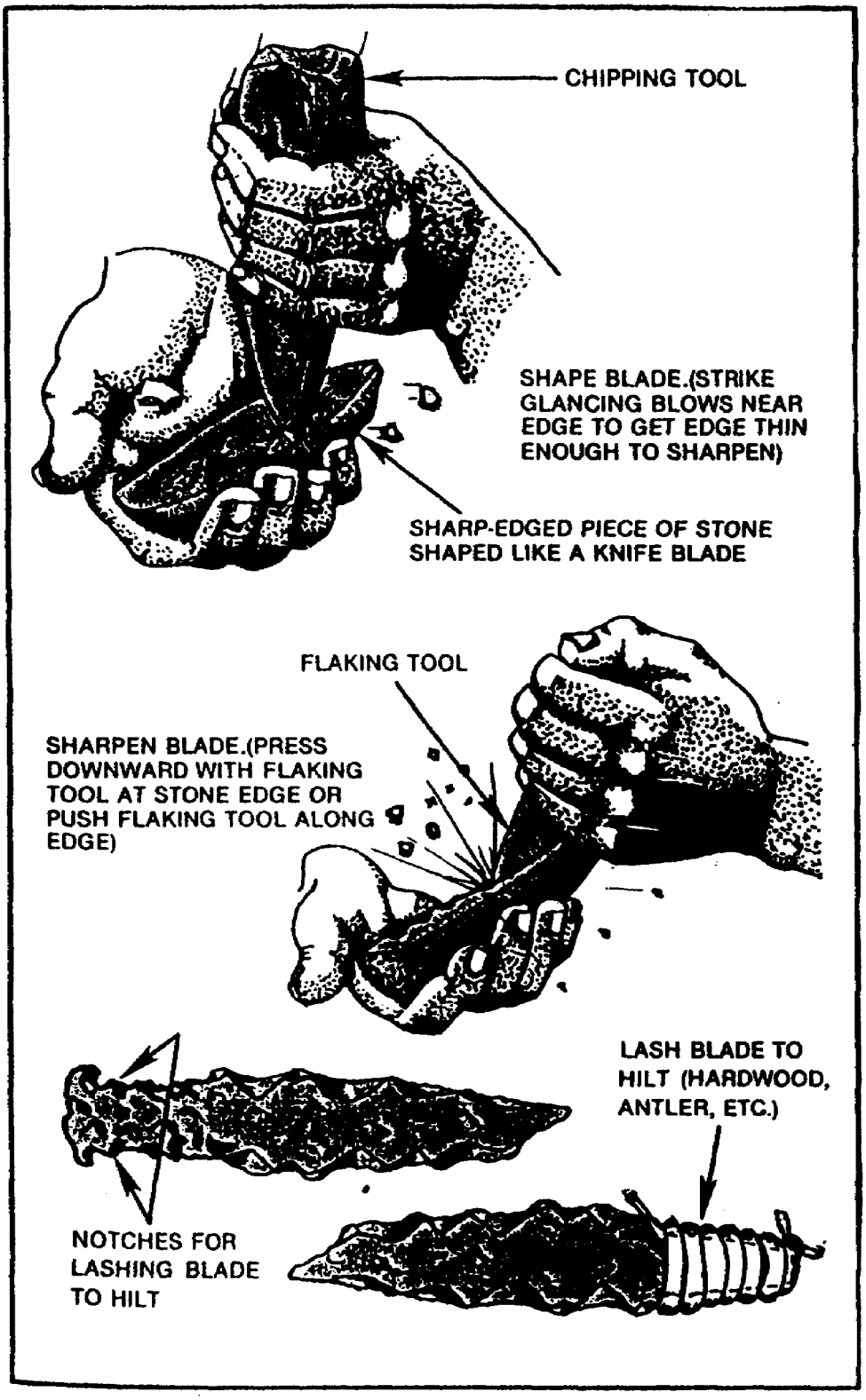


Figure 5. Making a stone spear point or knife blade.

d. Slingshot. Make a slingshot with a forked stick and the elastic from a parachute pack or surgical tubing from the night vision goggles (NVG) modification on the SPH-4 helmet (Figure 6). With practice, the slingshot can be very effective in killing small animals.

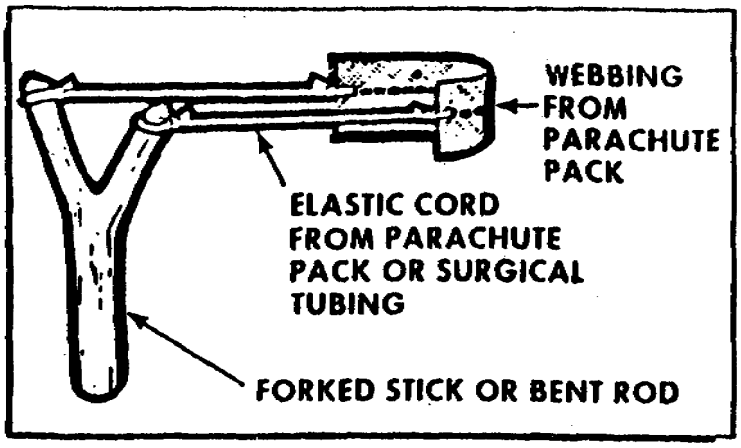


Figure 6. Slingshot.

e. Bola. The bola is another field expedient weapon that is easy to make (Figure 7). It is especially effective for capturing running game or low-flying fowl in a flock. To use the bola, hold it by the center knot and twirl it above your head. Release the knot so that the bola goes toward your target. When you release the bola, the weighted cords separate. These cords will wrap around and immobilize the fowl or animal that you hit.

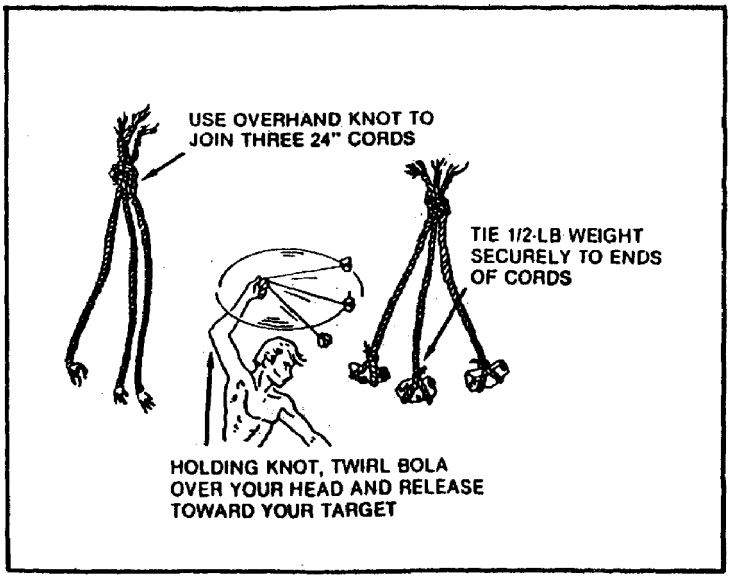


Figure 7. Bola.

6. TRAPS, SNARES, AND TRIGGERS

a. Traps. Trapping and snaring animals are ways you can procure animal food to supplement issued rations. Since small animals are more abundant and easier to kill than large animals, they will probably be your main source of food. Using traps and snares is more energy efficient than going out on foot and physically hunting animals. However, it can't be overemphasized that it takes several good traps to yield even one animal. It is also important to realize that this method is ineffective if you are constantly on the move. For the greatest success, you must place traps in areas where game live and travel. Behavioral studies show that the vast majority of game are encountered in greater numbers along the forest-field edge. Concentrate your search for activity in these areas. Look for signs such as tracks, droppings, feeding signs, or actual animal sightings. The most important advantage is that traps work 24 hours a day with no assistance from the hunter. A large area can be effectively trapped with the possibility of catching many animals within the same period of time. Use the following three ways to immobilize or trap animals:

(1) Strangle. Simply use a free-sliding noose which, when tightened around the neck, restricts circulation of air and blood. The materials should be strong enough to hold the animal.

EXAMPLES: String, wire, cable, rawhide, and suspension line.

(2) Mangle. Mangle traps use a weight suspended over the animal's trail or over bait. When the animal trips the trigger, the weight (log) descends and mangles the animal (Figure 8).

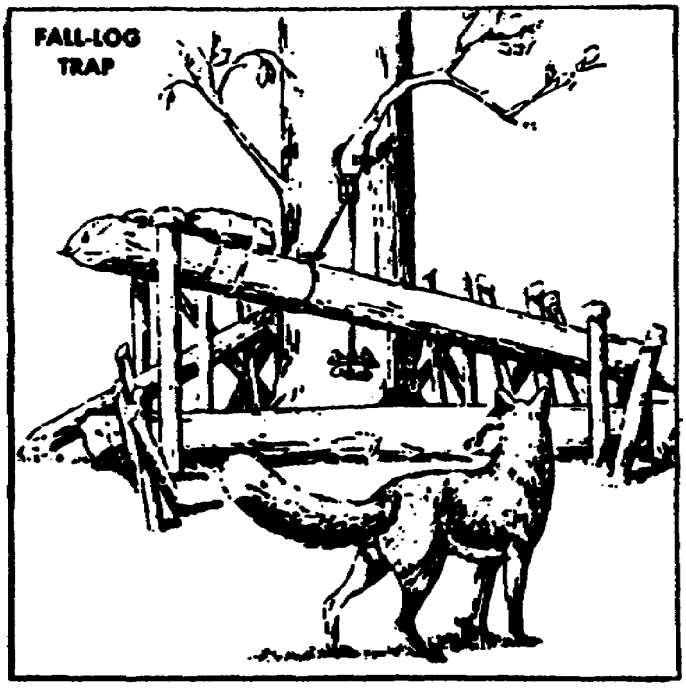


Figure 8. Mangle.

(3) Hold. Any means of impeding the animal and detaining its progress is considered a hold trap. The Apache foot snare and the bird box trap (Figure 9) are examples of hold traps.

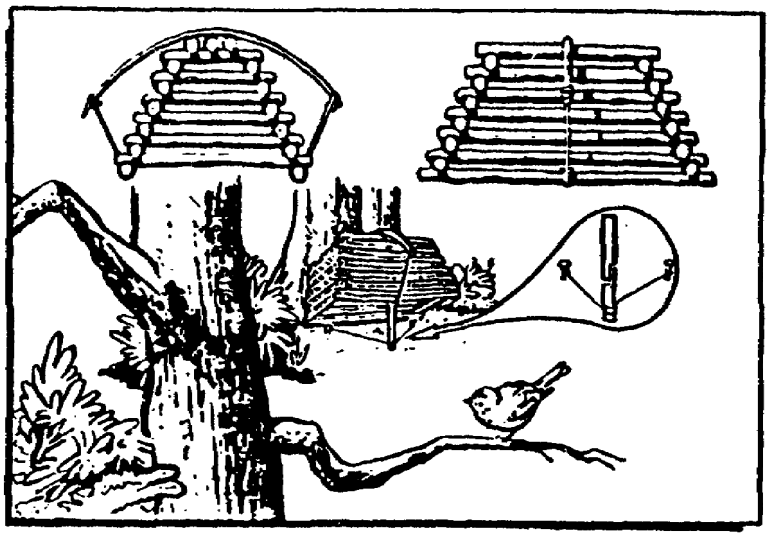


Figure 9. Box trap.

b. Snares. Snares may be set over holes or burrows or in a narrow game trail. If snares are used, set them to catch the animal around the neck. The loop must allow the head to pass through but not the body. Loops will vary in size from one animal to another. When placing snares, try to find a narrow area of the game trail where the animal has no choice but to enter the loop. If a narrow area cannot be found, brush or other obstacles can be arranged to funnel the animal into the snare (Figure 10). Do not overdo the funneling; use as little as possible. Avoid disturbing the natural surroundings if possible. Do not walk on game trails, but approach at a 90-degree angle to the trail, set the snare, and back away. Set all snares and traps during midday because most animals are nocturnal in nature. Check snares and traps twice daily. If possible, check after sunup and before sunset. Make the checks from a distance so any animals moving at the time of checking will not be disturbed or frightened away. Set snares out on a 15-to-1 ratio; in other words, set 15 snares for each animal expected to be caught.

(1) Apache foot snare. This snare is used for large browsers and grazers like deer (Figure 11). Locate it along game trails where an obstruction, such as a log, blocks the trail. When animals jump over this obstruction, a very shallow depression is formed where their hooves land. Place the Apache foot snare at this depression.

(2) Loop snare. The simple loop is the quickest snare to construct. Construct this loop from vines, inner core, suspension line, any type of bare wire, long strips of green bark, clothing strips, a belt, or any other material that will not break under the strain of holding the animal. If wire is being used for snares, use a figure "8" or locking

loop (Figure 12). Once tightened around the animal, the wire is locked into place by the figure "8." This prevents the loop from opening again. A simple loop snare is generally placed in the opening of a den with the end of the snare anchored to a stake or similar object. Use the simple loop snare when making a squirrel pole (Figure 13) or some types of trigger devices.

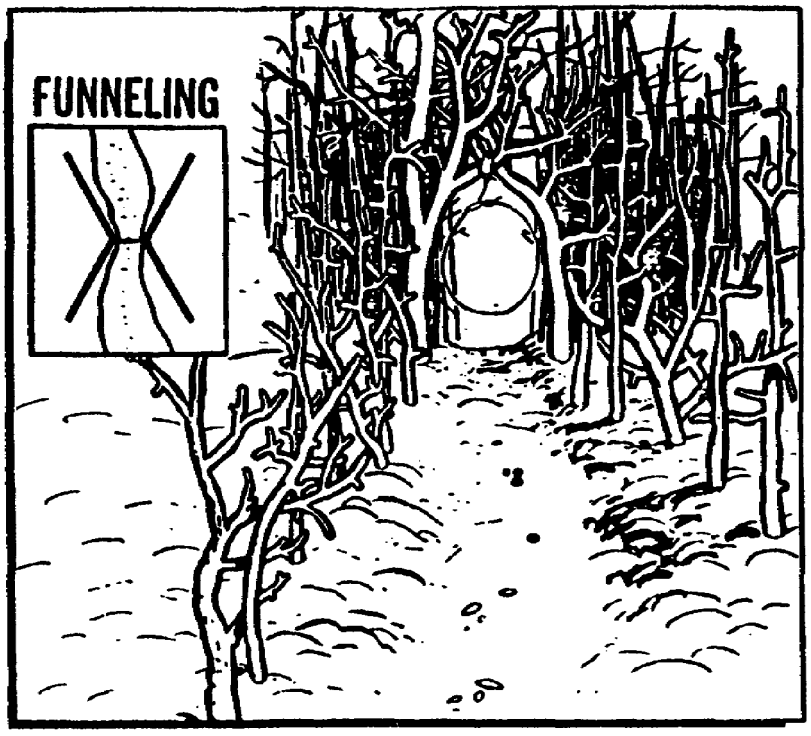


Figure 10. Funneling.

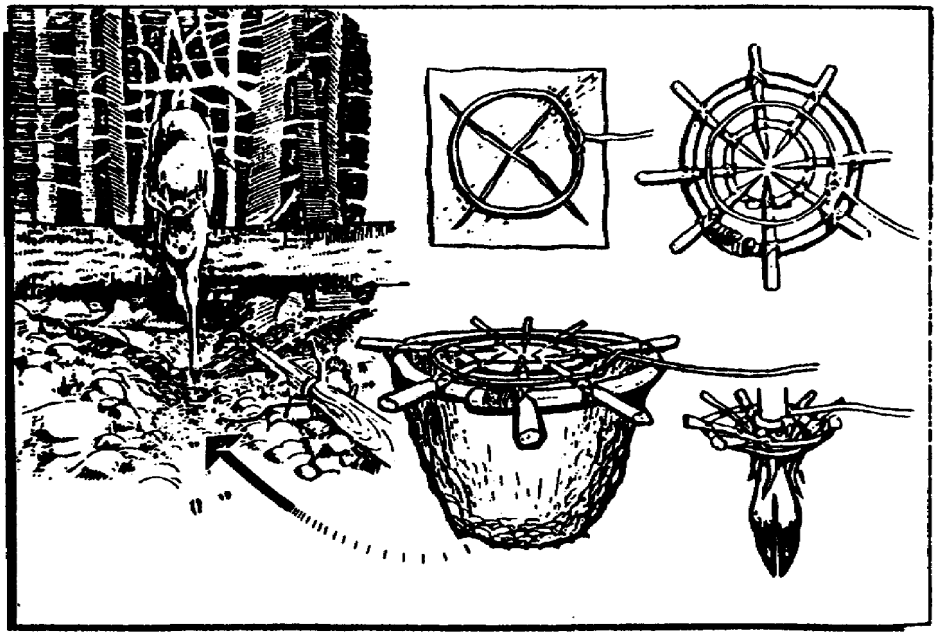


Figure 11. Apache foot snare.

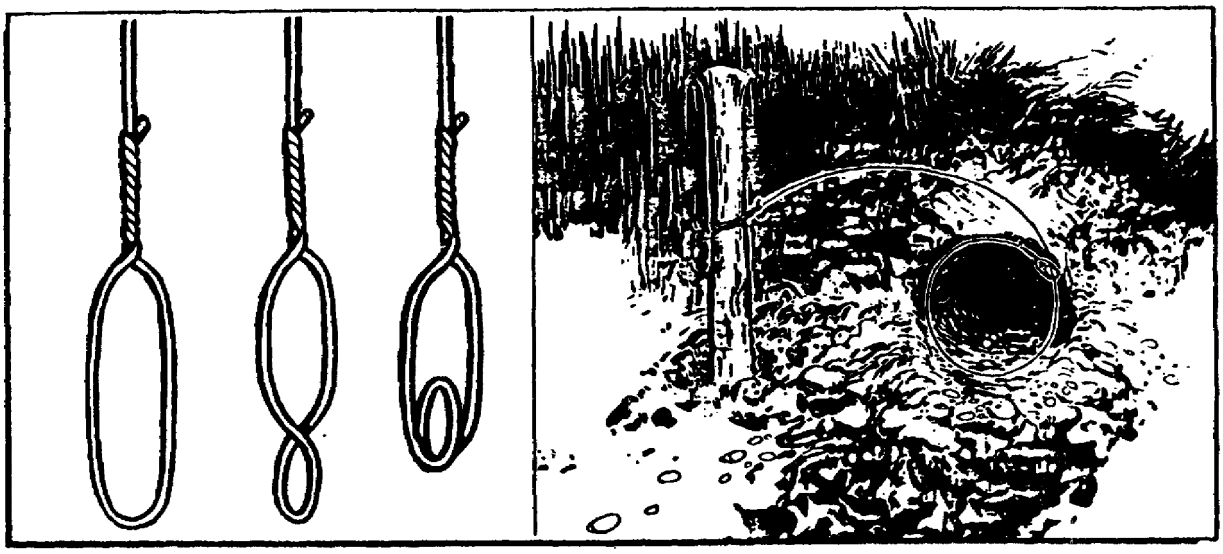


Figure 12. Locking loop and setting noose.

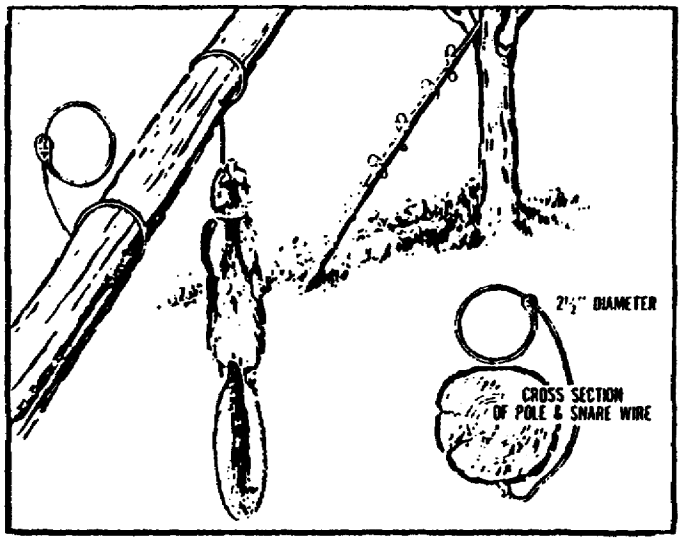


Figure 13. Squirrel pole.

c. Triggers. The purpose of the trigger is to set a device in motion that eventually holds, strangles, or mangles the animal. There are many triggers and some may be used with traps. Some of the more common ones are listed below.

(1) Small animals. The figure "H" with wire snare is used for small mammals and rodents (Figure 14). The twitch-up snare, incorporating the simple loops, can be used to catch small animals as well (Figure 15). When the animal is caught, the sapling jerks it up into the air and keeps the carcass out of the reach of predators. This type of snare does not work well in cold climates, since the bent sapling freezes in position and

does not spring up when released. Use a long forked stick as a twist stick to procure rabbits, ground squirrels, and so forth. Locate a den that has signs of activity. Using the long forked stick, probe the hole with the forked end until something soft is felt. Then twist the stick to entangle the animal's hide in the fork and extract the animal from the hole. (Figure 16).

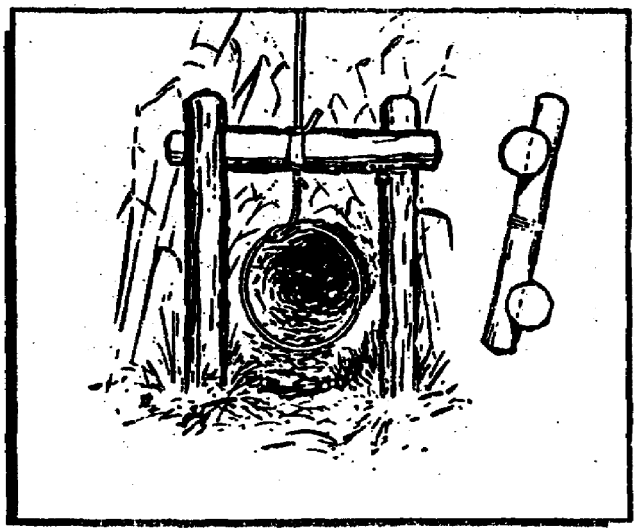


Figure 14. Figure H.

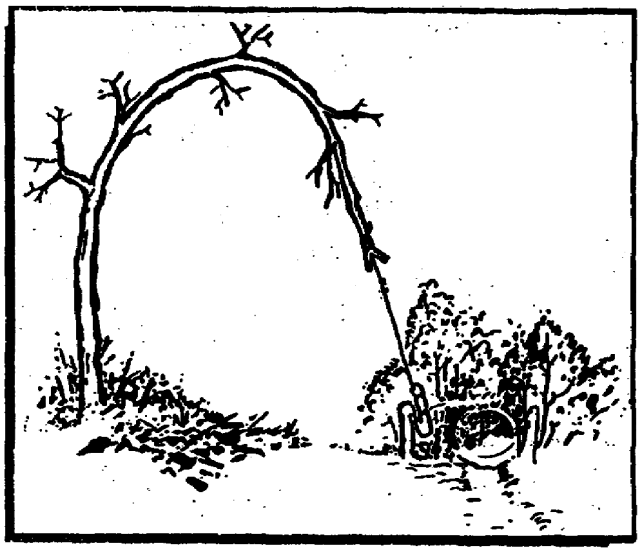


Figure 15. Twitch up.

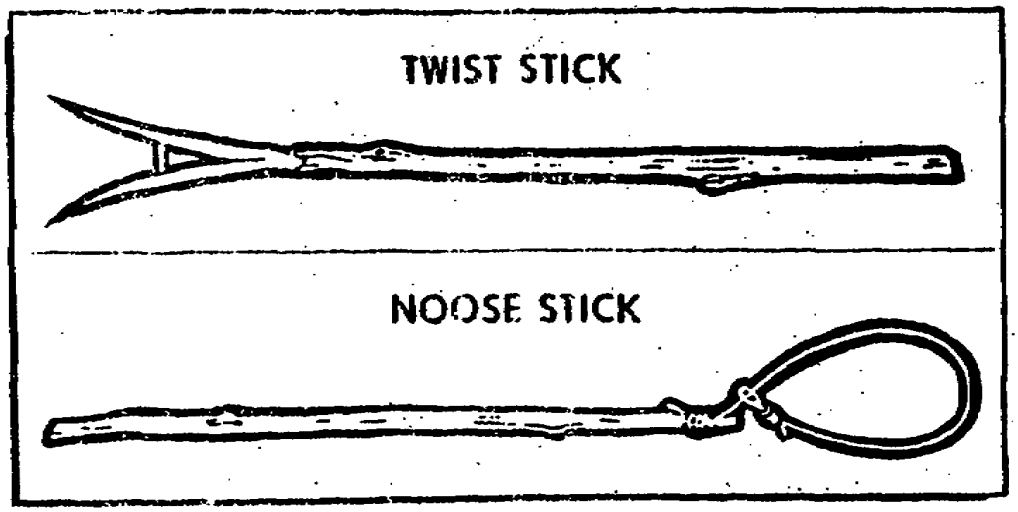


Figure 16. Twist stick and noose stick.

(2) Small-to-medium animals. The two-pin toggle with a counterweight is used to lift small-to-medium animals out of the reach of predators (Figure 17). The Canadian ace is used for predators such as the bobcat and coyote (Figure 18).

(3) Medium-to-large animals. The three-pin toggle with deadfall is used for medium to large animals (Figure 19). Medium and large animals can be captured using deadfalls, but this trap type is recommended only

when big game exists in large quantities to justify the great time and effort spent in constructing the trap.

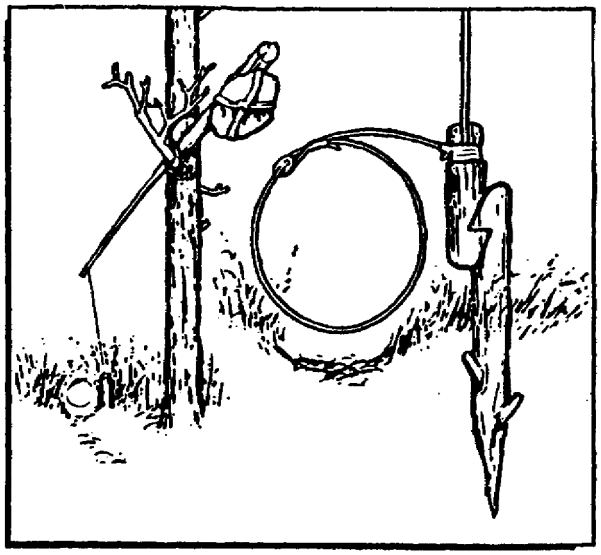


Figure 17. Two-pin toggle.

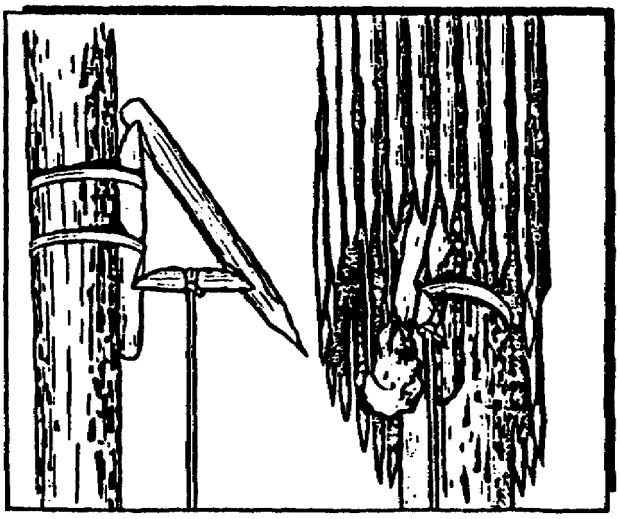


Figure 18. Canadian ace.

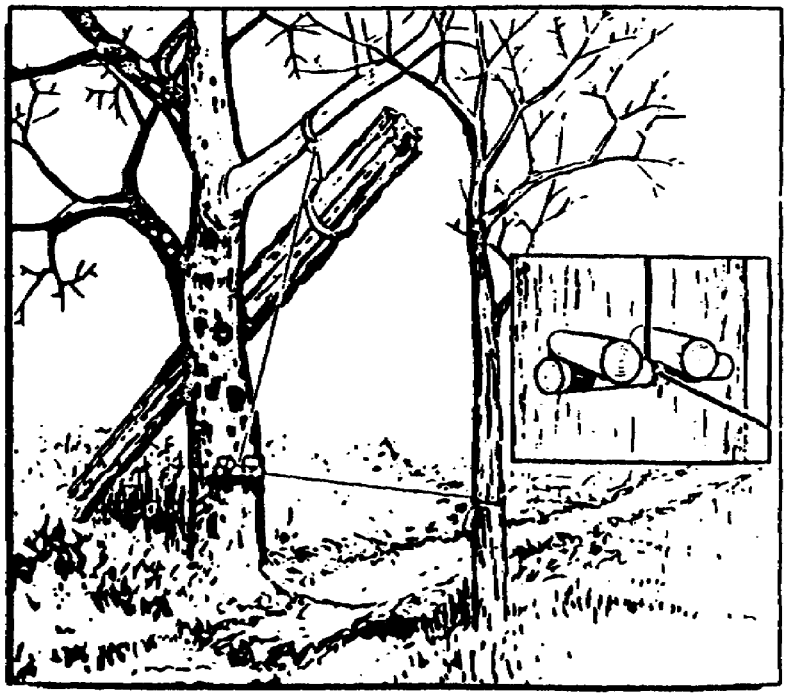


Figure 19. Three-pin toggle.

7. ANIMALS

Animal meat, an excellent source of nutrition, provides the body with essential fat and protein. Plan your hunting strategy in areas that

contain obvious signs of animal activity. Areas containing numerous animal trails are ideal for focusing your hunting and trapping efforts. Some of the animals found along game trails and used as food are mice, deer, bats, rats, snakes, lizards, wild pigs, squirrels, monkeys, hedgehogs, porcupines, anteaters, and wild cattle. In addition, some animals are found specifically in certain climates.

a. Tropical. There are more animal types in the jungles of the world than in any other region. However, a jungle visitor who is unaware of the life styles and eating habits of these animals would not observe the presence of a large number of animals.

(1) Reptiles, located in all jungles, should not be overlooked as a food source. Consider all snakes poisonous and be extremely cautious when killing this animal for a food source. Avoid all cobras. The spitting cobra aims for the eyes, and the venom can blind if not washed out immediately. Lizards are good food but may be difficult to capture since they can be extremely fast. A good blow to the head of a reptile usually kills it. Crocodiles and caimans are extremely dangerous on land as well as in the water.

(2) Avoid all frogs that are brilliantly colored and those frogs and toads in the tropics that secrete substances through the skin that have a pungent odor. These frogs and toads are often poisonous.

(3) The larger, more dangerous animals (tigers, elephants, rhinoceros, and water buffalo) are rarely seen and should be left alone. These larger animals are usually located in open grasslands.

b. Desert. When looking at a desert area, it is sometimes difficult to visualize an abundance of animal life existing in it. However, a great quantity of animal life is present.

(1) Larger mammals found in the desert consist of deer, foxes, small cats, badgers, dingoes, gazelles, antelope, and hyenas. These animals are amazingly abundant. Most are nocturnal and generally avoid humans. They roam at night eating smaller game and insects, and a few eat plants. Some of these animals can be hazardous; all should be approached with caution.

(2) Rats, rabbits, and prairie dogs have learned to live in deserts. They remain in the shade or burrow into the ground protecting themselves from direct sunlight and the hot desert surface.

(3) Snakes, lizards, and tortoises have adapted well to the desert environment. Care must be observed, though, when procuring them as some are hazardous, such as the Gila monster and rattlesnake. The desert tortoise, about a foot long when full grown, lives in some of the harshest regions of the Mohave and Sonora deserts. It is club footed, herbivorous, and crawls about 20 feet per minute. The tortoise converts some of its food into water that is stored for the hot months in two sacs under the

upper shell. A pint of water lasts throughout the dry season. In spring and fall, the tortoise browses in broad daylight, becoming livelier as the day warms up. In the summer heat, it may come out of its shallow burrow in the early morning, the late evening, or not at all.

c. Arctic. In these climates, food is more difficult to find than water. Animal life is normally more abundant during the warm months, but still it can be found in the cold mouths. All animals in the arctic regions are edible, but the livers of seals and polar bears must not be eaten because of the high concentration of vitamin A. Death could result from ingesting large quantities of the liver. On the open sea ice, such game animals as: seal, fox, walrus, and polar bear are available.

(1) Seal is probably your main source of food when stranded on the open sea ice. They are, found in open leads, areas of thin-ice, or where snow has drifted over a pressure ridge forming a cave that could have open water or very thin ice. These areas may also house polar bears which feed primarily on seals. You should avoid polar bears.

(a) Newborn seals have trouble staying afloat or swimming and are found on the ice in the early summer. The seal cubs are easily killed with a club, spear, knife, or firearm and are an excellent source of food. The meat, blubber (fat), and coagulated milk in their stomachs are edible. When killing a cub, it is best to keep a lookout for the mother. She tends to protect offspring in any way possible.

(b) Seals must surface periodically to breathe. When the icepack is thin, the seals poke their noses through the ice and take a breath of air in a lead or in open water. In thick ice, the seal chews or claws a breathing hole through the ice. Normally, most seals have more than one breathing hole. When hunting seals, it is best to take a position beside a breathing hole and wait until a seal comes up to breathe, then spear it or strike it on the head with a club. Seals are very sensitive to blows on or about the dose. Often they lose consciousness but do not die. Suspend a hook through the breathing hole so it hangs down at least 6 inches below the ice. When a seal comes to breathe, it can become hooked when it tries to depart the breathing hole. Seals can be recovered by gaffing or grabbing by hand. In some cases, the breathing hole might have to be enlarged to pull the body through. If the seal is killed in open water, a manak or grapple hook can be used to retrieve it. Recover immediately all seals killed in open water or those that fall into open water. During the cold months, they will float for quite awhile; during the warm months or when a female is nursing young, they sink rapidly. This is because of the loss of body fat.

(2) On tundras there are large game, small game, and birds available as a food source.

(a) Examples of large game are sheep, wolves, bears, deer, caribou, and musk oxen. Large game are sometimes dangerous and often difficult to kill without the use of a firearm. Even standard issue

pistols and rifles are inadequate for some species of large game. Avoid bears, wolves, and the large members of the cat family altogether. The safest and most effective method to kill large animals is to hunt from a stationary position (stand) along a well used trail. Positioning yourself downwind of approaching animals and on an elevated platform, such as a tree, helps mask your scent and reduce your risk of being injured by a wounded animal.

(b) Small game include hares, mice, lemmings, marmots, foxes, and ground squirrels. They may be trapped or killed throughout the year. When snaring, it is best to use a simple loop made of strong line or a two-stranded twisted wire. The double wire is necessary since metal becomes brittle in the cold and breaks very easily. Other snares and triggers are less effective in the cold climate. You can use a gill net as a snare by spreading it across a trail so that the animal entangles itself.

(3) As in the tundra, forested areas in the arctic and arctic-like areas abound in wildlife. Large game species include moose, deer, bear, and caribou. Small game include hares, squirrels, muskrat, beaver, and porcupine. They can be snared or trapped easily in winter or summer. Small animal trails are found in the winter with great ease. Most animals do not like to travel in deep snow. They tend to travel the same trail most of the time, and this trail looks like a small superhighway-the snow packed down well below the normal snow level. Most trails are also located in heavy cover, in undergrowth, or parallel to roads and open areas. Normally, the same trails are used during the summer.

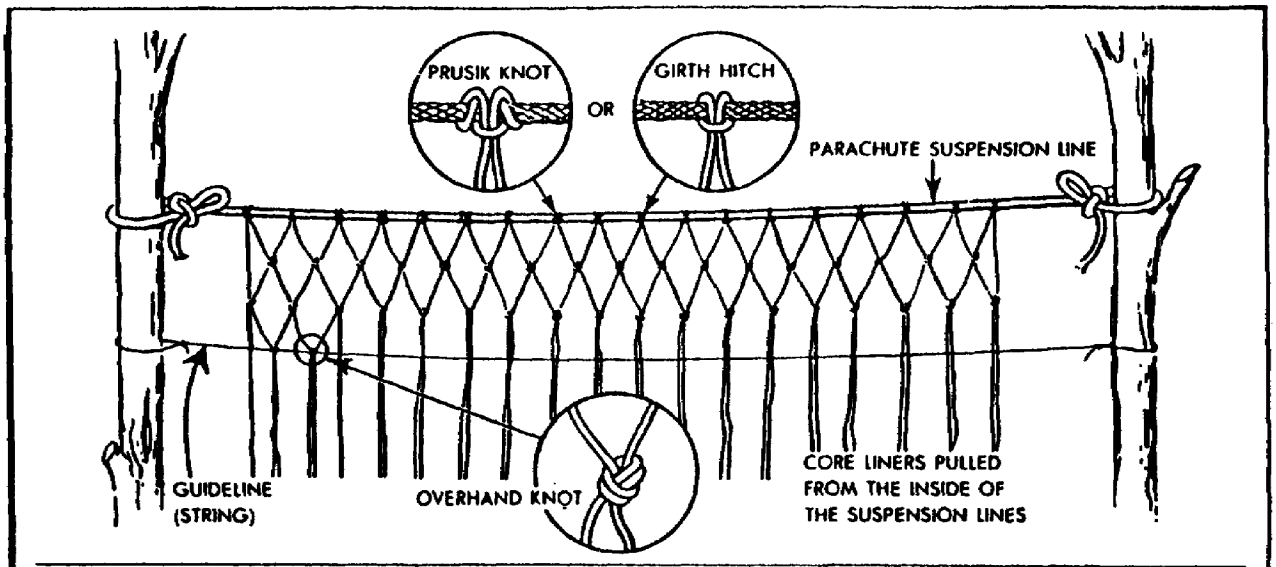
8. BIRDS

a. During molting season, birds cannot fly because they lose their "flight" feathers. At this stage, they can be procured by clubbing or netting.

(1) In wooded areas, many larger bird species, such as spruce grouse and ptarmigan, may be approached. The spruce grouse has merited the name of "fools hen." It can be approached and killed with a stick with little trouble. Often it sits on the lower branches of trees and can be easily caught with a long stick with a loop at the end (Figure 16).

(2) When using nets, set them up at night vertically to the ground in some natural flyway, such as an opening in dense foliage. You can make a net by using the inner core from a parachute suspension line (Figure 20). Also you can use a small net on a wooden frame with a disjointed stick for a trigger.

b. You can catch birds on baited fishhooks (Figure 21) or with simple slipping loop snares. When many birds frequent a particular type of bush, set up some simple loop snares throughout the bush. Make the snares as large as necessary for the particular type of bird that comes to perch, feed, or roost there (Figure 22).



1. Suspend a suspension line casing (from which the core liners have been pulled) between two uprights, approximately at eye level.

2. Hang core liners (an even number) from the line suspended as in 1, above. These lines should be attached with a Prusik knot or girth hitch and spaced in accordance with the mesh you desire. One-inch spacing will result in a 1-inch mesh, etc. The number of lines used will be in accord with the width of the net desired. If more than one man is going to work on the net, the length of the net should be stretched between the uprights, thus providing room for more than one man to work. If only one man is to make up the net, the depth of the net should be stretched between the uprights and step 8, below, followed.

3. Start at left or right. Skip the first line and tie the second and third lines together with an overhand knot. Space according to mesh desired. Then tie fourth and fifth, sixth and seventh, etc. One line will remain at the end.

4. On the second row, tie the first and second, third and fourth, fifth and sixth, etc., to the end.

5. Third row, skip the first line and repeat step 3 above.

6. Repeat step 4, and so on.

7. You may want to use a guide line which can be moved down for each row of knots to ensure equal mesh. Guide line should run across the net on the side opposite the one you are working from so that it will be out of your way.

8. When you have stretched the depth between the uprights and get close to ground level, move the net up by rolling it on a stick and continue until the net is the desired length.

9. String suspension line casing along the sides when net is completed to strengthen it and make the net easier to set.

Figure 20. Making a bird net.

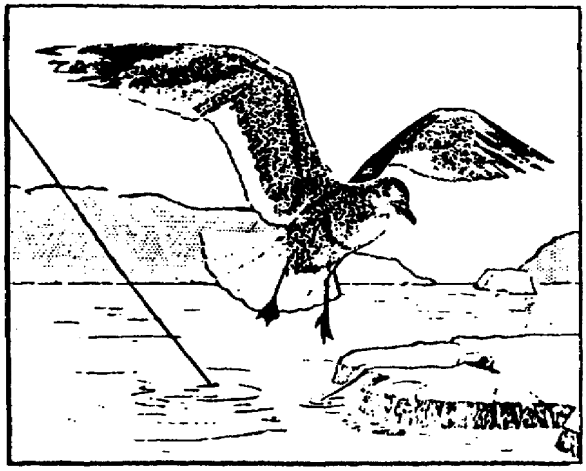


Figure 21. Baited fishhook.

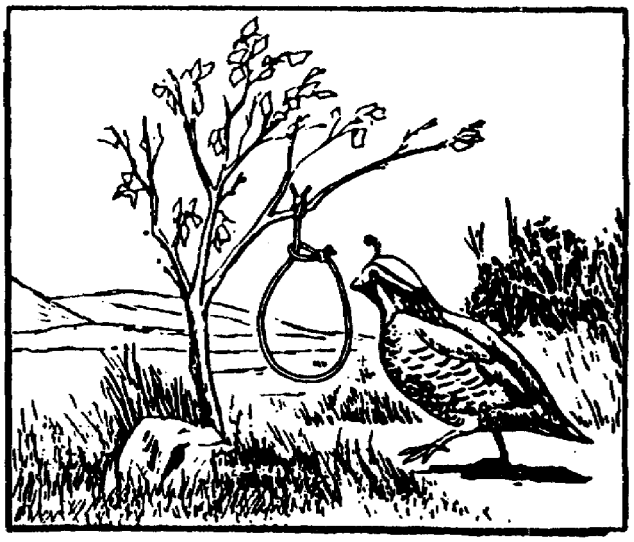


Figure 22. Ptarmigan or small game snare.

c. Birds also can be caught in an Ojibwa snare. Make this snare by cutting a 1-or 2-inch thick sapling at a height of 4 1/2 to 5 feet above the ground (Figure 23). Then whittle flat a springy branch at the butt end and cut a rectangular hole through the flattened end. Then whittle one end of a 1/2-inch thick stick, 15 inches long, to fit slightly loose in the hole. Round off the top corner of the whittled end so the stick will easily drop away from the hole. Then tie the branch by its butt end to the top of the sapling and tie a length of inner core from the suspension line to the bottom end of the branch. Bend the branch into a bow with the line passing through the hole in the butt end. Tie a knot in the line, and then place the 15-inch stick in the hole to lock the line in place (just behind the knot). Make an 8-inch loop at the end of the line and lay it out on the 15-inch stick (spread out as well as possible). Place a piece of bait on top of the sapling. When a bird comes to settle on the 15-inch stick, the stick drops from the hole causing the loop to tighten around the bird's legs.

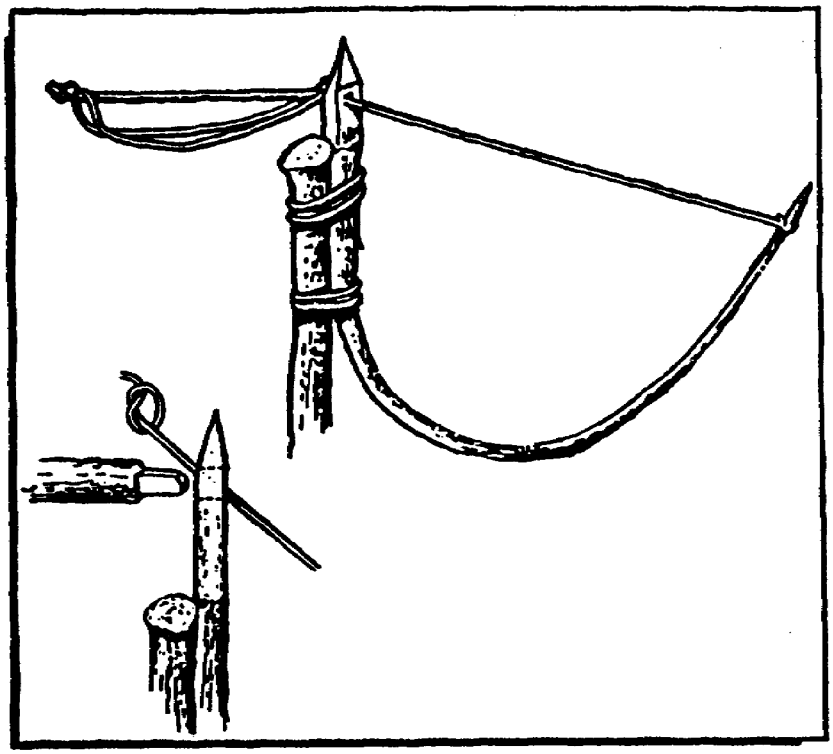


Figure 23. Ojibwa bird snare.

d. Ground feeding birds (quail, Hungarian partridge, and chukar) can be trapped in a trench dug into the ground. Make the trench just wide enough for the bird to walk into after first observing the type of ground feeding birds in the area. The trench should be 2 to 3 feet long and about 10 to 12 inches deep at the deep end. The other end of the trench should be ramped down from the surface level. Bait is scattered along the surface into the pit. After having pecked the last piece of bait, the bird will not be able to get out of the pit because it can't fly out or climb out. Its feathers keep it from backing out, and it can't turn around to walk out.

e. Perching birds may be captured by using bird lime. Bird lime is a term applied to any sticky or gluey substance that is rubbed on a branch to prevent a bird which has landed on it or has flapped a wing against it from flying away. Bird lime is usually made from the sap of plants in the Euphorbia family (spotted spurge, cypress spurge, snow-on-the-mountain, and poinsettias). The Euphorbias have a wide range in North and Central America. The milky sap is poisonous and may cause blisters on the skin; therefore, it should be handled with care. Bird lime is most effective in the desert and jungle, but it will not work in cold weather. Dust makes bird lime ineffective, so use it in spots where dust is not prevalent. The sap of the breadfruit tree makes excellent bird lime as it swells and becomes glutinous on contact with air.

f. Birds are plentiful during the summer months regardless of the climate. Procure them by spearing, clubbing, catching with a baited fishhook, or using a weapon.

(1) Arctic. Surface water is generally plentiful because of the number of lakes, ponds, bogs, and marshes. Birds and water fowl are very abundant and include ducks, terns, geese, gulls, owls, and ptarmigan. The eggs and young birds are excellent food sources and are easily procured.

(2) Desert. In general, desert birds stay in areas where some shade exists. Many need water daily; therefore, most are found within short flights of some type of water source. Many birds migrate during the drought season. If an abundance of birds is seen, normally insects, vegetation, and a water source is nearby.

9. INSECTS

If there ever is a time when food aversions must be overcome, it is when survivors must turn to insects as a food source. It is a socially accepted custom in many primative cultures to seek insects as a source of food. Many species are even considered delicacies. Today we know that insects have nutritional or medicinal value. The praying mantis, for instance, contains 58 percent protein, 12 percent fat, 3 percent ash, vitamin B complex, and vitamin A. The insect's outer skeleton is an interesting compound of sugar and amino acids. At the peak of seasonal plant growth, the land crawls and buzzes with an enormous number and variety of beetles, ants, wasps, moths, and bugs. In the desert they appear with the first good rains and generally feed during the nighttime. In some places, locusts, crickets, cicadas, and grasshoppers are eaten regularly; occasionally ants, termites, and a few species of stonefly larvae are consumed. Big beetles (the goliath beetle of Africa, the giant water beetles, and the big long horns) are relished the world over. Clusters, like those of the snipefly atherix (that overhang the water) and the windrows of Brinefly puparia, are eaten. The Ute Indians of North America have harvested crickets, and the peoples of the Middle East have roasted locusts. The human diet in Mexico and the American Indians of the Southwest frequently includes grasshoppers and caterpillars. Aquatic water bugs of Mexico are grown especially for food. All stages of growth are

eaten including the eggs, but large insects must be cooked to kill internal parasites. Insects have been used as a food source for thousands of years and will undoubtedly continue to be used. Insects are also an efficient food source from the standpoint that very little energy is required to catch them. You must not overlook their nutritional value. Included among those insects that are edible are those listed below.

a. Termites and white ants are important food sources. Strangely enough, these insects are closely related to cockroaches. The reason they are eaten so extensively in Africa is the fact that they occur in enormous numbers and are easily collected from their nests and during their flight. They are sometimes attracted to light in unbelievable numbers, and the natives become greatly excited when the large species appear.

b. Carpenter ants were once included in the diet of many American Indian tribes. The indians ate them raw as well as cooked. Today these animals are considered a pest because of the damage they cause to the wood structures of houses (Figure 24).

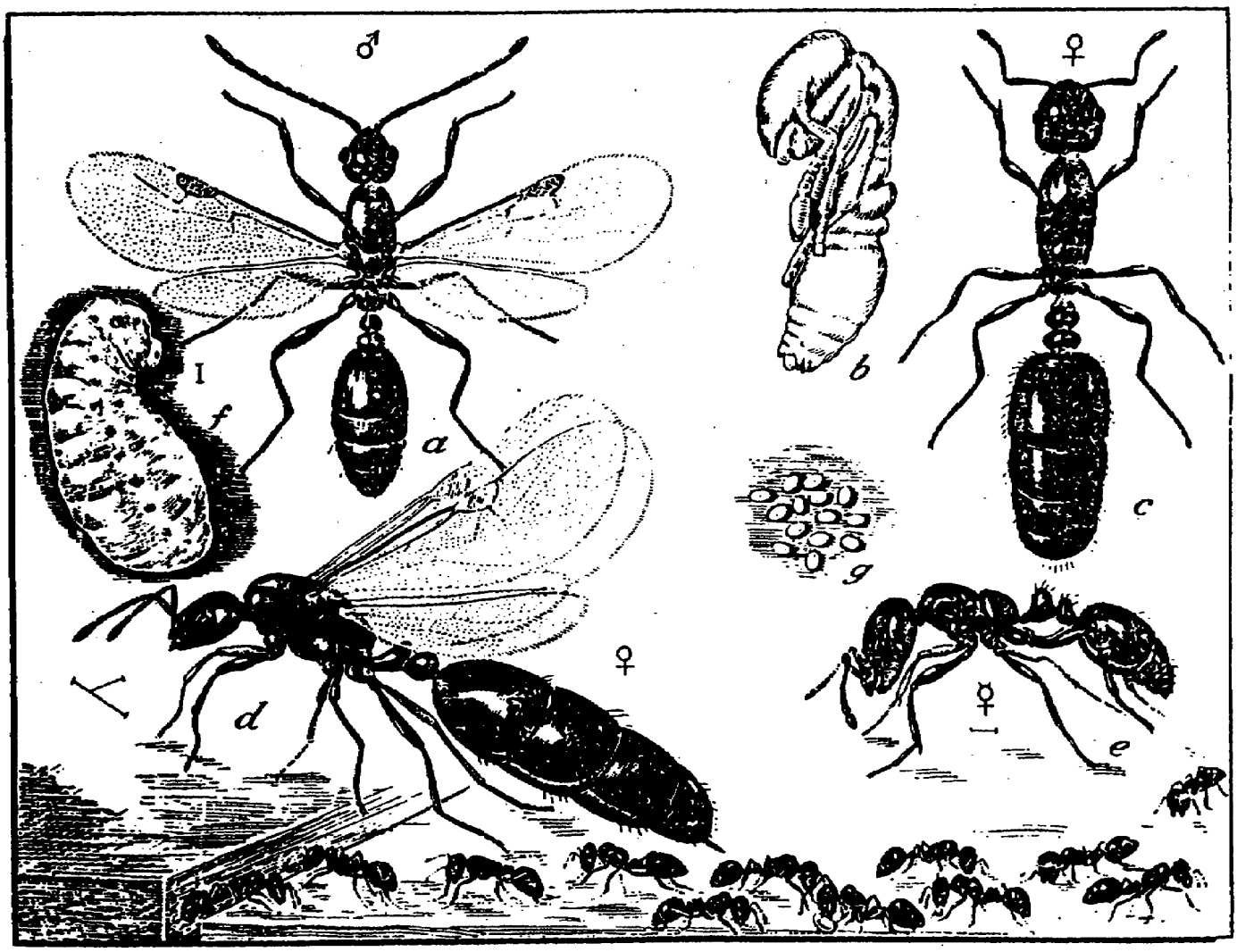


Figure 24. Ants.

c. The American Indians relished the honey ants in all parts of the continent where they occur. These ants are peculiar in that some of the workers become veritable storehouses for honey. Their abdomens become more or less spherical and so greatly enlarged that they are scarcely able to move. They cluster on the ceilings and walls of their nests and disgorge part of their stored food to other inhabitants. The Indians discovered the sweetness stored in these insects and made full use of it. At first they ate the ants alive. Later they gathered them in quantity and crushed them so that they formed an enticing dish--one that was considered a delicacy. This they served to distinguished guests as a special favor. The next step in using the honey ant was extracting the pure honey by crushing the insects and straining the juices. After extracting the honey, it was allowed to ferment forming what is said to be a highly flavored wine.

d. Indians of the American tropics have a much larger selection of ant types to choose from. They select the queens of the famous leafcutting or so-called umbrella ants eating only the abdomens, either raw or cooked.

e. Caterpillars, the larvae of moths and butterflies, are often large or occur in great abundance. Therefore, it is natural that they form a very substantial part of the food of primitive peoples. In Africa, many tribes consider caterpillars choice morsels of food. Much time is spent in collecting them. Some of the native tribes recognize 20 or more different kinds of caterpillars that are edible. These people are sufficiently well acquainted with the life history of the insects to know the plants on which they feed and the time of year when they have reached the proper stage of development for collecting. Avoid caterpillars with hairs. If eaten, the hairs may become lodged in the throat causing irritation or infection.

f. Other edible insects include bee larvae that were once eaten by the ancient Chinese. Some Chinese today eat locusts, dragonflies, and bumblebees. Cockroaches and locusts are a favorite dish in Szechwan. In Kwangtun, crickets, grasshoppers, golden June beetles, and wasp and silkworm larvae are used for food.

NOTE: Stinging insects should have their stinging apparatus removed before they are eaten.

10. PLANTS

The thought of having a diet consisting only of plant food is often distressing to stranded aircrew members. This is not the case if the survival situation is entered into with confidence and intelligence based on knowledge or experience. If you know what to look for, can identify it, and know how to prepare it properly for eating, there is no reason why you can't find sustenance. Survivors can enjoy a nutritious diet of wild plants if they have a previous knowledge of plant identification. A documented and authoritative example of the value of a strictly plant diet in survival

is the case of a Chinese botanist who had been drafted into the Japanese Army during World War II. Isolated with his company in a remote section of the Philippines, the Chinese botanist kept 60 of his fellow soldiers alive for 16 months by finding wild plants and preparing them properly. He selected six men to assist him and then found 25 examples of edible plants in the vicinity of their camp. He acquainted the men with these samples, showing them what parts of the plants could be used for food. He then sent the men out to look for similar plants and had them separate the new plants according to the original examples to avoid any poisonous plant mingling with the edible ones. The result of this effort was impressive. Though all the men had a natural craving for ordinary food, none suffered physically from the plant food diet. The survival episode was especially valuable because the botanist kept a careful record of all the food used, the results, and the comments of the men. This case history reflects the same opinions as those found in questionnaires directed to American survivors during World War II.

a. Advantages.

(1) Plants provide carbohydrates; therefore, they provide body energy and calories. Carbohydrates keep weight and energy up and include important starches and sugars.

(2) Another advantage of a plant diet is availability. In many instances, a situation may present itself in which procuring animal food is out of the question because of injury, exhaustion, or being unarmed, in enemy territory, or in an area that lacks wildlife. If convinced that vegetation can be depended on for daily food needs, the next question is "where to get what and how." Experts estimate there are about 300,000 classified plants growing on the surface of the earth. Many thrive on mountain tops and on the floors of oceans. There are two considerations that survivors must keep in mind when procuring plant foods: can the plant be consumed without ill effects and is it palatable. If it includes an inedible or poisonous variety in its family, the edible plant must be distinguishable to the average eye from the poisonous one. You will find some plants that are completely edible. However, many plants have only one or more identifiable parts having nutritional value. Usually a plant is selected because one special part is edible, such as the stalk, the fruit, or the nut. The variety of plant component parts that might contain food value is shown in Figure 25.

b. Edibility Test. To aid in determining plant edibility, you should observe certain general rules and perform an edibility test. Select a plant that grows in sufficient quantity within the local area to justify the edibility test and provide a lasting course of food if the plant proves edible. In selecting plant foods, consider selecting plants that resemble those cultivated by people. It is risky to rely on a plant (or parts thereof) that is edible for human consumption simply because animals have been seen eating it. For instance, horses eat leaves from poison ivy and some rodents eat poisonous mushrooms. Monkeys put poisonous plants and fruits in pouches of their mouths and spit them out later.

There are exceptions to every rule, but when selecting unknown plants to consume, plants with certain characteristics should be avoided. Plants that do not have these characteristics can be considered as possible food sources. Apply the universal edibility test (Figure 26) to only one plant at a time. If some abnormality does occur, it will be obvious which plant causes the problem. Once a plant has been selected, apply the following general rules and then proceed with the edibility test.

Underground Parts	**Tubers** **Roots and Rootstalks** **Bulbs**
Stems and Leaves (potherbs)	**Shoots and Stems** **Leaves** **Pith** **Bark**
Flower Parts	**Flowers** **Pollen**
Fruits	**Fleshy Fruits (dessert and vegetable)** **Seeds and Grains** **Nuts** **Seed Pods** **Pulps**
Gums and Resins	
Saps	

Figure 25. Edible parts of plants.

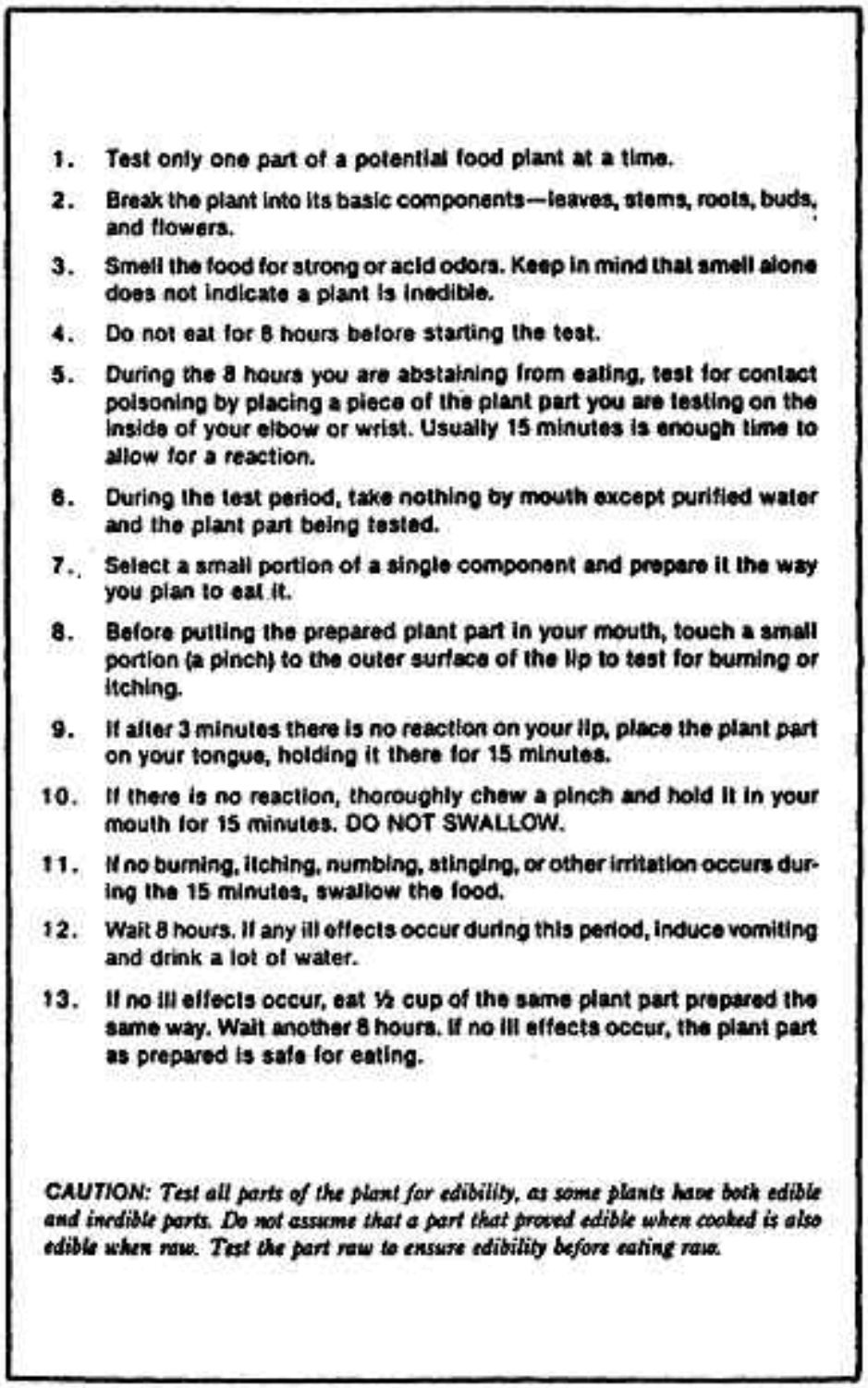
(1) Safe.

(a) Aggregated fruits and berries, (thimbleberry, raspberry, salmonberry, and blackberry) are always edible.

(b) Blue or black berries are generally safe.

(c) Single fruits on a stem are generally considered safe to eat.

(d) Plants growing in the water or moist soil are often the most palatable. Plants are less bitter when growing in shaded areas.



1. Test only one part of a potential food plant at a time.
2. Break the plant into its basic components—leaves, stems, roots, buds, and flowers.
3. Smell the food for strong or acid odors. Keep in mind that smell alone does not indicate a plant is inedible.
4. Do not eat for 8 hours before starting the test.
5. During the 8 hours you are abstaining from eating, test for contact poisoning by placing a piece of the plant part you are testing on the inside of your elbow or wrist. Usually 15 minutes is enough time to allow for a reaction.
6. During the test period, take nothing by mouth except purified water and the plant part being tested.
7. Select a small portion of a single component and prepare it the way you plan to eat it.
8. Before putting the prepared plant part in your mouth, touch a small portion (a pinch) to the outer surface of the lip to test for burning or itching.
9. If after 3 minutes there is no reaction on your lip, place the plant part on your tongue, holding it there for 15 minutes.
10. If there is no reaction, thoroughly chew a pinch and hold it in your mouth for 15 minutes. DO NOT SWALLOW.
11. If no burning, itching, numbing, stinging, or other irritation occurs during the 15 minutes, swallow the food.
12. Wait 8 hours. If any ill effects occur during this period, induce vomiting and drink a lot of water.
13. If no ill effects occur, eat ½ cup of the same plant part prepared the same way. Wait another 8 hours. If no ill effects occur, the plant part as prepared is safe for eating.

CAUTION: Test all parts of the plant for edibility, as some plants have both edible and inedible parts. Do not assume that a part that proved edible when cooked is also edible when raw. Test the part raw to ensure edibility before eating raw.

Figure 26. Universal edibility test.

(2) Unsafe.

(a) Mushrooms and fungi should not be selected. Fungi have toxic peptides, a protein-base poison that has no taste. There is no safe field test to determine whether an unknown mushroom is edible. Anyone

gathering wild mushrooms for eating must be absolutely certain of the identity of every specimen picked. Some species of wild mushrooms are even difficult for an expert to identify. Because of the potential for poisoning, do not rely on mushrooms as a viable food source.

(b) Completely avoid plants with umbrella-shaped flowers although dill, carrots, celery, and parsley are members of this family. Although poisonous water plants are rare, one of the most poisonous plants, poison water hemlock, is also a member of this family (Figure 27). It is found around marshes and ponds.

(c) Avoid all of the legume family (beans and peas). They absorb minerals from the soil and cause problems. The most common mineral absorbed is selenium. Selenium gives locoweed (Figure 28) its fame (locoweed is a vetch).

(d) As a general rule, avoid all bulbs. Examples of poisonous bulbs are tulips and death camas (Figure 29).

(e) White and yellow berries are almost always poisonous. Approximately one-half of all red berries are poisonous (Figure 30).

(f) Plants with shiny leaves are considered poisonous--use caution. A milky sap also indicates a poisonous plant.

(g) Do not eat plants that irritate the skin, such as poison ivy. Some other poisonous plants include those in Figures 31 through 34.

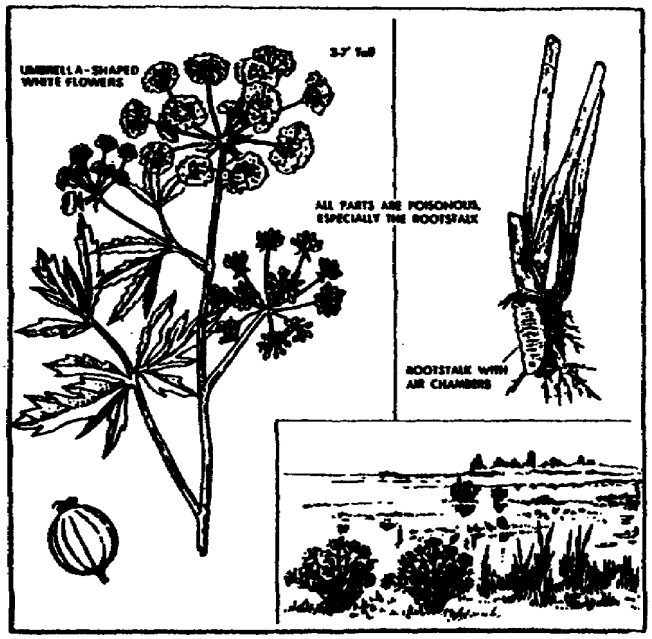


Figure 27. Water hemlock.

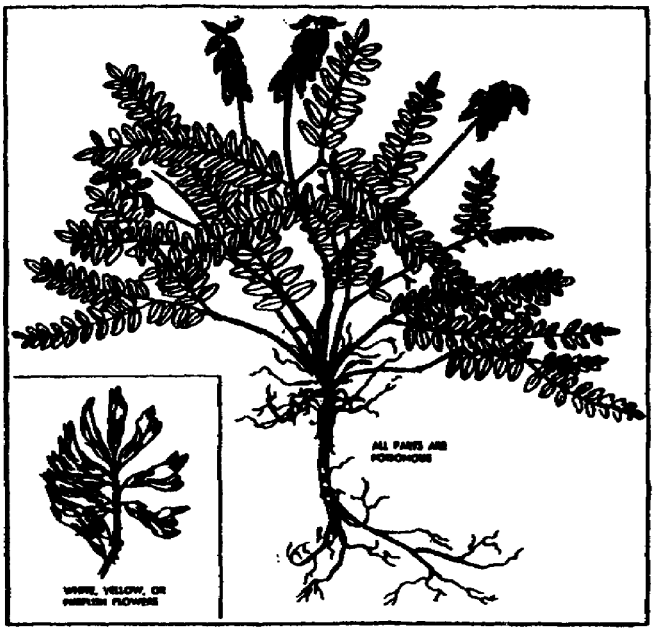
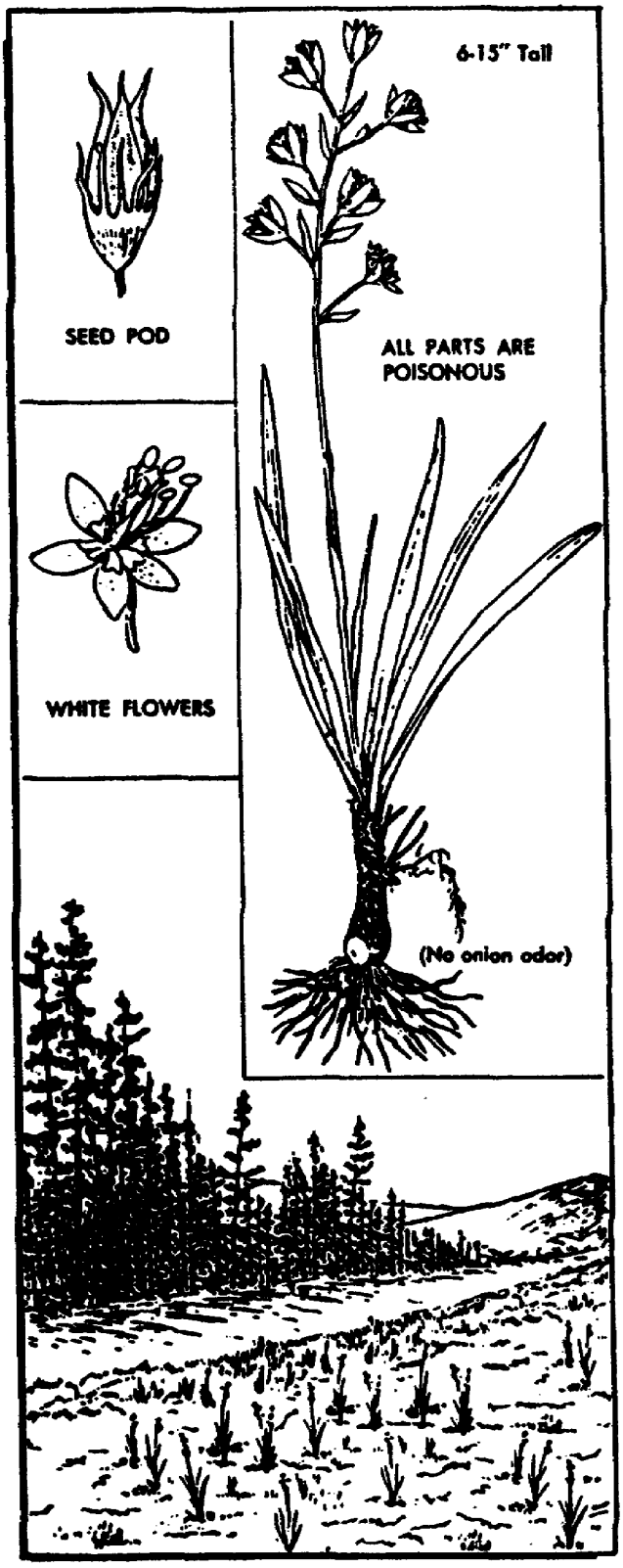


Figure 28. Vetch and locoweed.


SEED POD
WHITE FLOWERS
6-15" Tall
ALL PARTS ARE POISONOUS
(No onion odor)


White flowers

Figure 29. Death camas.

Figure 30. Baneberry.

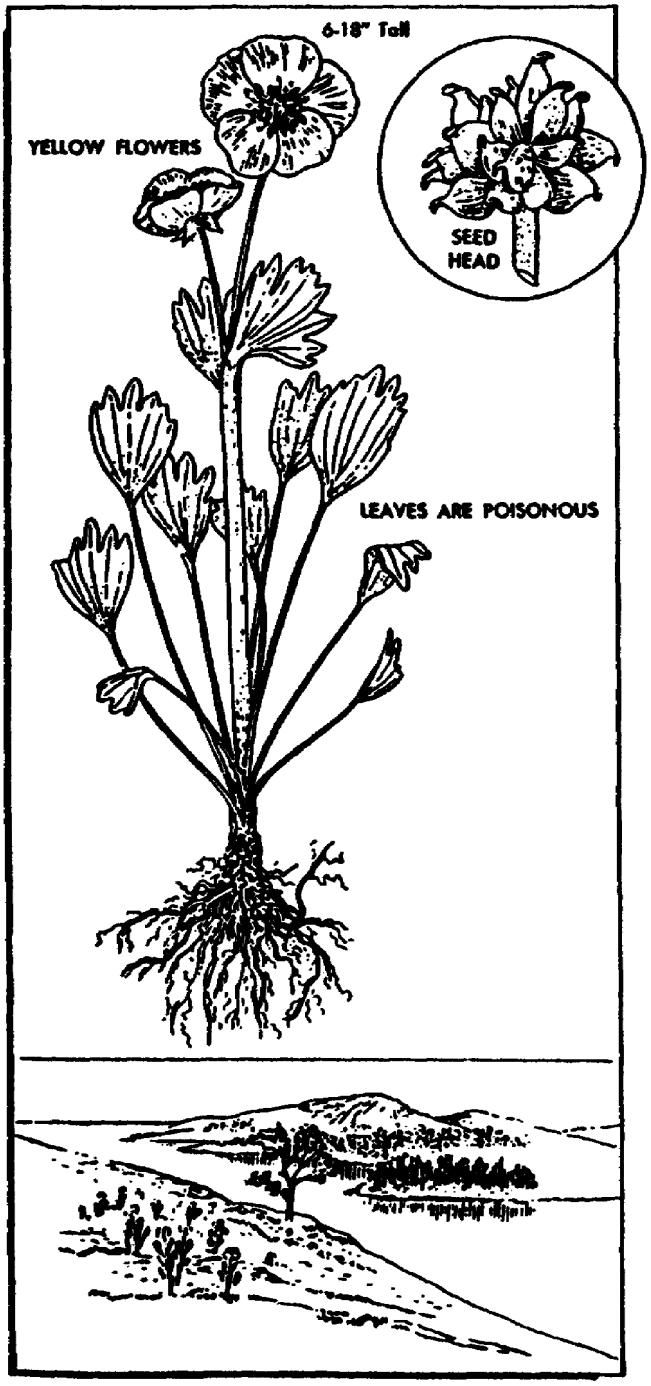


Figure 31. Buttercup.

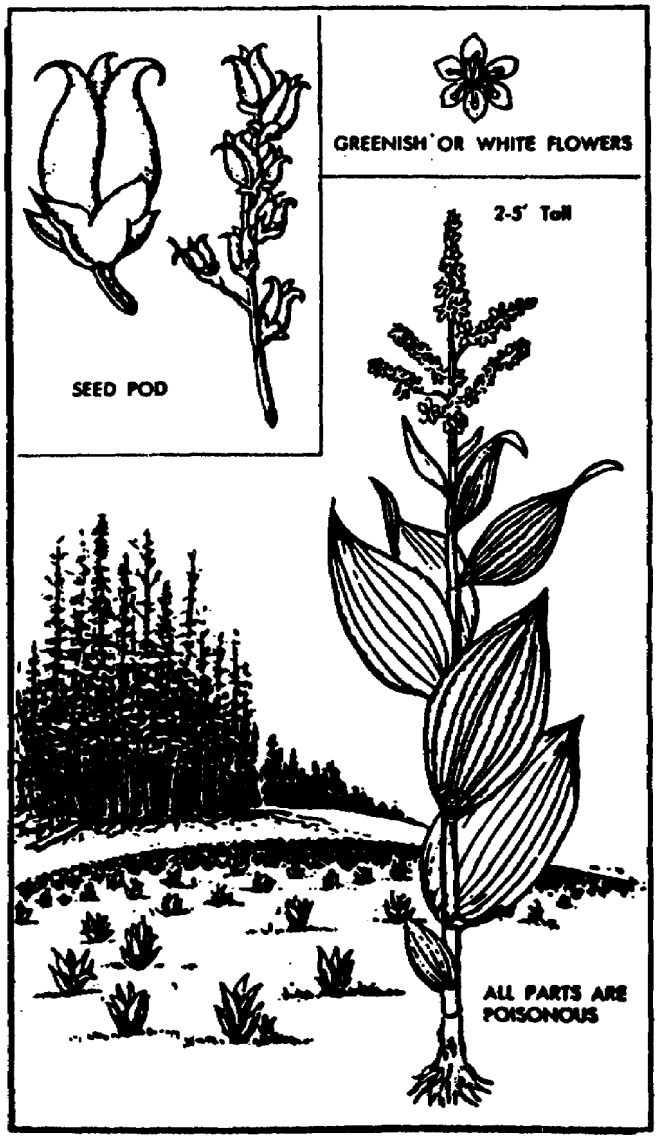


Figure 32. False hellebore.

c. Edible Plants.

(1) Underground parts.

(a) Tubers. Tubers, usually found below the ground, are rich in starch. Cook them by roasting in an earth oven or by boiling to break down the starch to ease digestion. Water lilies (nymphaea and nuphar) occur on all the continents but principally in Africa, southern

Asia, North America, and South America (Figure 35). The two main types are temperate and tropical. Tropical water lilies produce large edible tubers and flowers that are elevated above the water surface. Plants with edible tubers include the taro, yam bean, tropical yam, cassave (tapioca), chufa (nut grass), tropical water lily, East Indian arrowroot, and sweet potato (kamote).

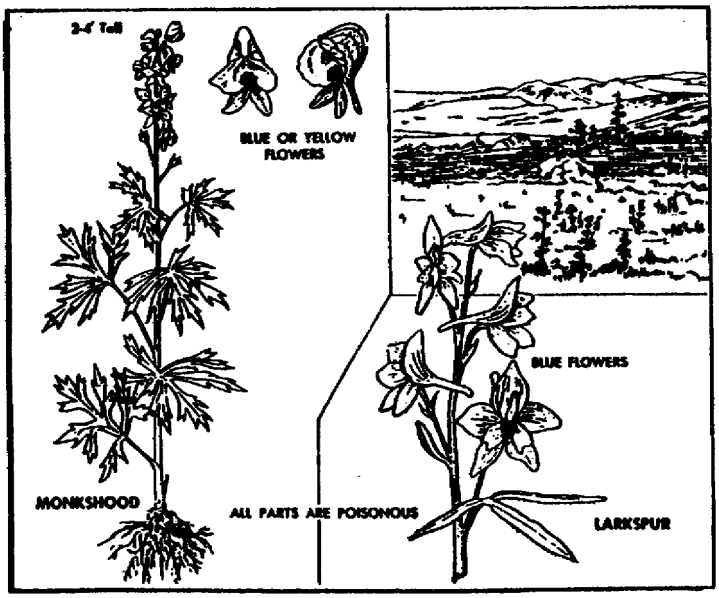


Figure 33. Monkshood and larkspur.

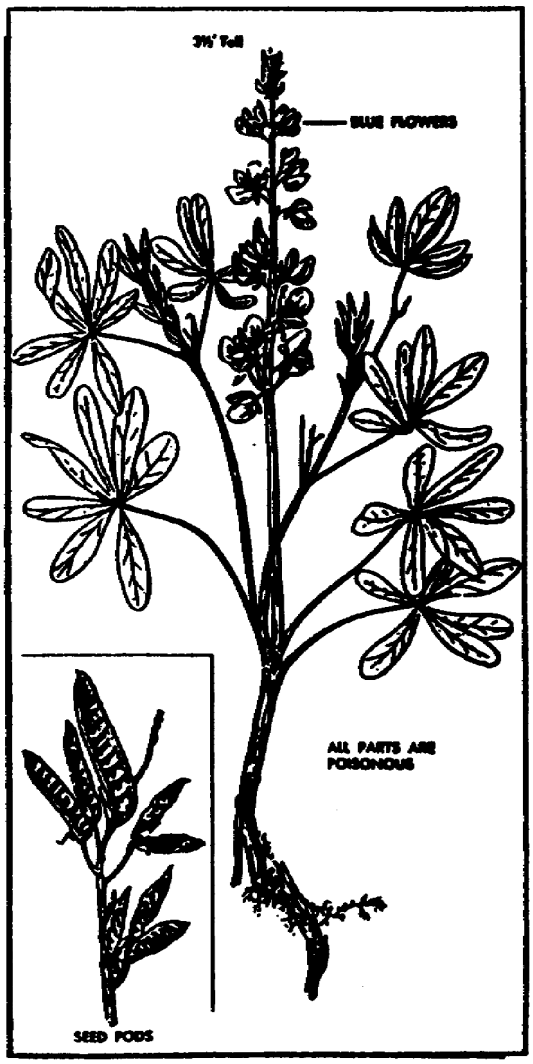


Figure 34. Lupine.

(b) Roots and rootstalks. Many plants produce roots that may be eaten. Edible roots are often several feet in length. In comparison, edible rootstalks are underground portions of the plant that have become thickened and are relatively short and jointed. True roots and rootstalks are storage organs rich in stored starch. Temperate water lilies produce enormous rootstalks and yellow or white flowers that float on the water. The cattail (Typha) is found worldwide except in tundra regions of the far north (Figure 36). Cattails can be found in the more moist places in desert areas of all continents as well as in the moist tropic and temperate zones of both hemispheres. Plants with edible roots or rootstalks (rhizomes) include those listed in Figure 37.

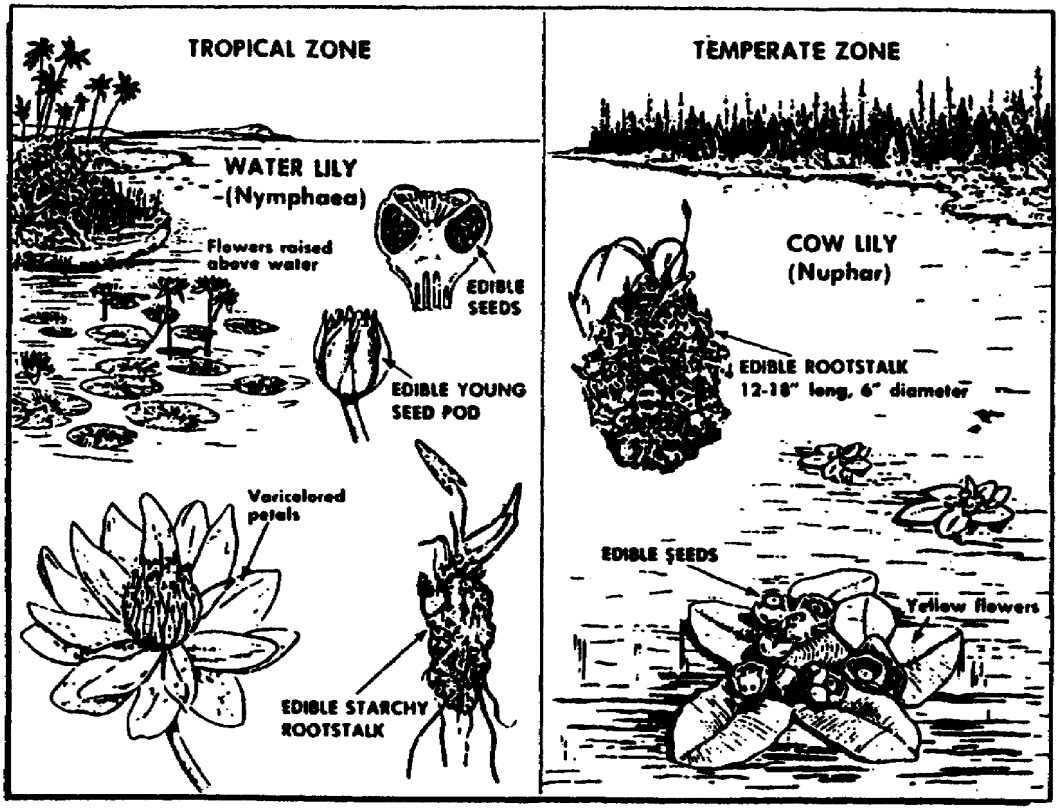


Figure 35. Water lilies.

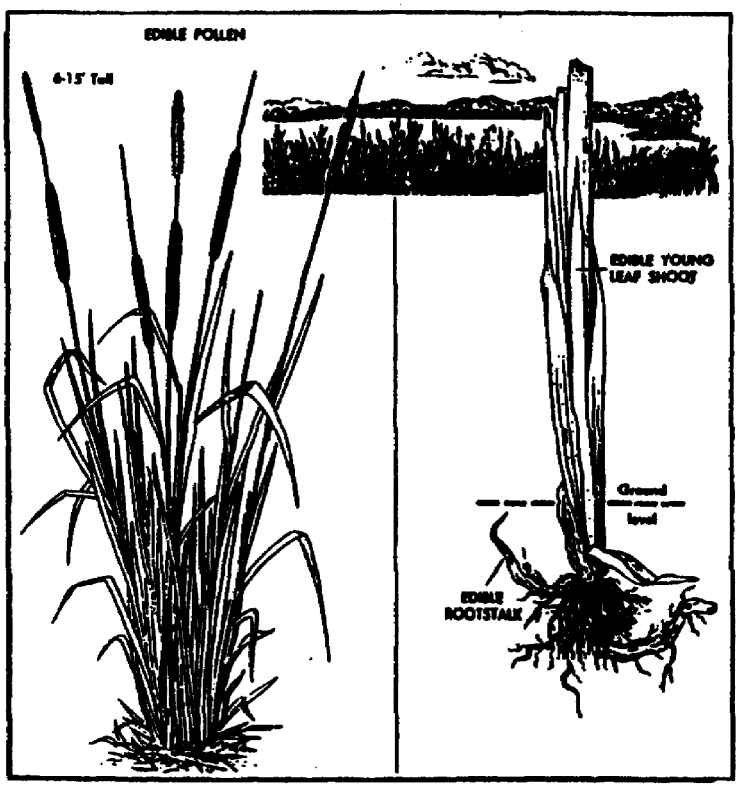


Figure 36. Cattails.

baobab	**tree fern**	**reindeer moss**
manioc	**pollypody**	**water plantain**
cattail	**rock tripe**	**flowering rush**
chikory	**canna lily**	**Ceylon spinach**
bracken	**lotus lily**	**wild calla (water arum)**
Ti plant	**screw pine**	**water lily (temperate zone)**
goa bean	**horseradish**	

Figure 37. Edible roots and rootstalks.

(c) Bulbs. The most common edible bulb is the wild onion, easily detected by its characteristic odor. Wild onions are eaten uncooked, but other kinds of bulbs are more palatable if they are cooked. In Turkey and Central Asia, you can eat the bulb of the wild tulip. All bulbs contain a high percentage of starch. (Some bulbs are poisonous, such as the death camas that have white or yellow flowers.) Some of the plants with edible bulbs include the wild lily, tiger lily, wild tulip, wild onion, and blue camas.

(2) Shoots and leaves.

(a) Shoots (stems). All edible shoots grow in much the same fashion as asparagus. The young shoots of ferns (fiddleheads) and especially those of bamboo and numerous kinds of palms are desirable for food. Some kinds of shoots are eaten raw, but most are better if first boiled for five to ten minutes (parboiled). Drain off the water and re-boil the shoots until they are sufficiently cooked for eating (Figure 38). Other edible shoots are listed in Figure 39.

(b) Leaves. The leaves of spinach-type plants (wild mustard, wild lettuce, and lamb quarters) are eaten either raw or cooked. These plans are also known as potherbs. Prolonged cooking, however, destroys most of the vitamins. Plans that produce edible leaves are perhaps the most numerous of all edible plants. The young tender leaves of nearly all nonpoisonous plants are edible. Some of the plants with edible leaves are listed in Figure 40.

(c) Pith. Some plants have an edible pith in the center of the stem. The pith of some kinds of tropical plants is quite large. Pith of the sago palm is particularly valuable because of its high food value. Sore of the palms-with edible pith (starch) include the buri, sago, sugar, rattan, coconut, and fishtail.

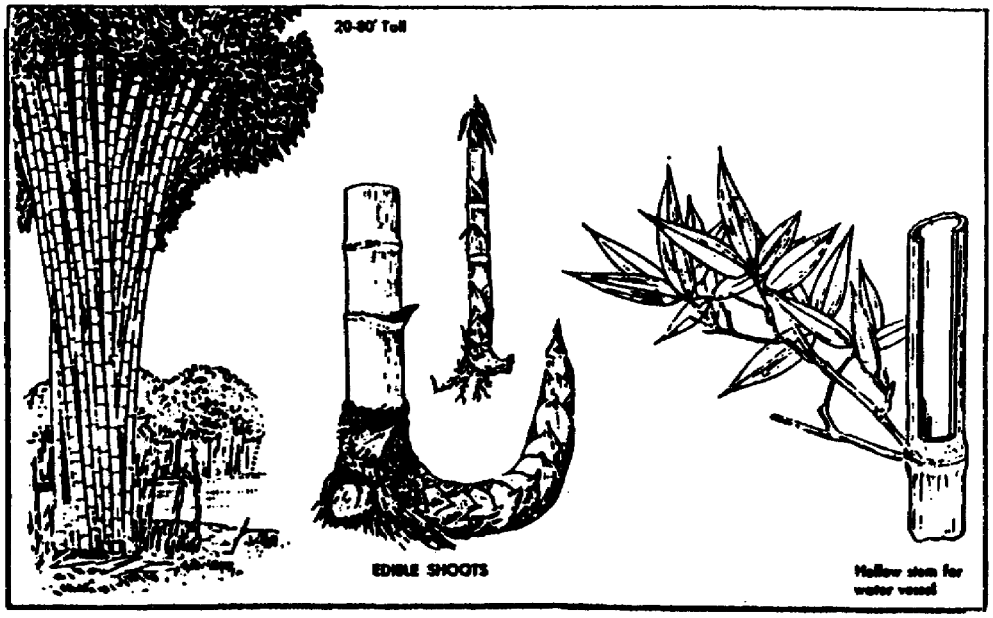


Figure 38. Bamboo.

papaya	nipa palm	coconut palm
bamboo	sago palm	reindeer moss
bracken	rock tripe	fishtail palm
cattail	sugar cane	arctic willow
purslane	lotus lily	Ceylon spinach
goa bean	sugar palm	sweet potato (kamote)
polypody	rattan palm	water lily (tropical)
colocynth	luffa sponge	agave (century plant)
buri palm	wild rhubarb	pokeweed (poisonous roots)

Figure 39. Edible shoots.

dock	purslane	prickly pear
mango	Ti plant	water lettuce
baobab	goa bean	arctic willow
papaya	sea orache	reindeer moss
avocado	rock tripe	Ceylon spinach
cassava	screw pine	spreading wood fern
amaranth	lotus lily	sweet potato (kamote)
chickory	horseradish	taro (only after cooking)
plantain	wild sorrel	pokeweed (poisonous roots)
tamarind	luffa sponge	

Figure 40. Edible leaves.

(d) Bark. Always avoid the outer bark of a tree because it contains large amounts of bitter tannin. However, the inner bark--the layer between the outer bark and the inner core--is eaten raw or cooked. In northern areas you can make flour from the inner bark of such trees as the pine, aspen, birch, willow, and cottonwood. Pine bark is high in vitamin C. The outer bark of pines can be cut away and the inner bark stripped from the trunk and eaten fresh, dried, or cooked; it may be pulverized into flour. Bark is most palatable when newly formed in spring. As food, bark is most useful in the arctic regions where plant food is often scarce.

(3) Flower parts.

(a) Flowers and buds. You can eat fresh flowers as part of a salad or to supplement a stew. The hibiscus flower is commonly eaten throughout the southwest Pacific area. In South America, the people of the Andes eat nasturtium flowers. In India, it is common to eat the flowers of many kinds of plants as part of a vegetable curry. Flowers of desert plants are also eaten. Other plants with edible flowers include the papaya, banana, colocynth, wild caper, horseradish, and luffa sponge.

(b) Pollen. Pollen looks like yellow dust. All pollen is high in food value, especially that of the cattail. You can easily collect quantities of pollen and eat it as a kind of gruel.

(4) Fruits. Edible fruits are divided into sweet and nonsweet (vegetable) types. Both are the seed bearing parts of the plant. Sweet fruit plants are often plentiful in all areas of the world. For instance, in the far North there are blueberries and crowberries; in the temperate zones there are plums, cherries, and apples; and in the American deserts there are fleshy cactus fruits. Tropical areas have more kinds of edible fruit than other areas, and a list would be endless. Sweet fruits may be cooked or for maximum vitamin content left uncooked. Common vegetable fruits include the pepper, tomato, and cucumber. Plants with edible sweet fruits and vegetable types are listed in Figure 41.

SWEET

mango	**wild fig**	**jackfruit**	**cloudberry**	**prickly pear**
papaya	**mulberry**	**pokeberry**	**wild apple**	**common jujube**
banana	**cranberry**	**bel fruit**	**wild grape**	**bullocks heart**
soursop	**crabapple**	**rose apple**	**huckleberry**	**wild blueberry**
sweetsop				

VEGETABLE

plantain	**breadfruit**	**horseradish**	**wild caper**	**luffa sponge**

Figure 41. Edible fleshy fruit.

(c) Seeds and grains. Seeds of many plants (buckwheat, ragweed, goosefoot, and amaranth) contain oils and are rich in protein. The grains of all cereals and many other grasses, including millet, are also extremely valuable sources of plant protein. They may be either ground between stones, mixed with water and cooked to make porridge or parched or roasted over hot stones. In this state, they are still wholesome and may be kept for long periods without further preparation (Figure 42). Other plants with edible seeds and grains are listed in Figure 43.

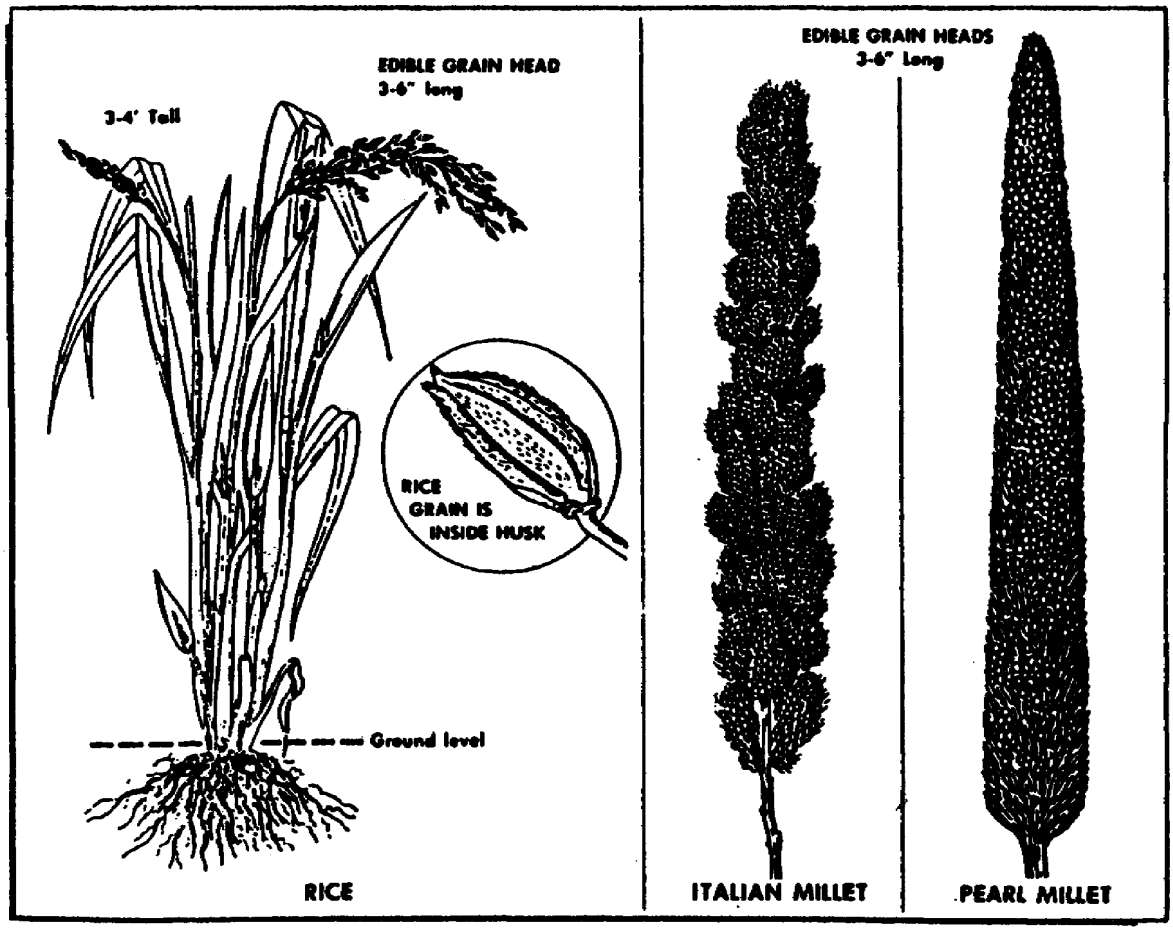


Figure 42. Grains.

rice	purslane	sea orache	Italian millet
bamboo	goa bean	lotus lily	St. John's bread
baobab	colocynth	screw pine	water lily (tropical)
amaranth	sterculia	pearl millet	water lily (temperate)
tamarind	nipa palm	luffa sponge	

Figure 43. Edible seeds and grains.

(d) Nuts. Nuts are among the most nutritious of all raw plant foods and contain an abundance of valuable protein. Plants bearing edible nuts occur in all the climatic zones of the world and in all continents except in the arctic regions. Inhabitants of the temperate zones are familiar with a few (walnuts, filberts, almonds, acorns, beechnuts, pine nuts, hazelnuts, and hickory nuts). Tropical zones produce brazil nuts, cashew nuts, macadamia nuts, and palm nuts such as coconuts (Figure 44). Most nuts are eaten raw, but some (acorns) are better when cooked. Some plants with edible nuts include those listed in Figure 45.

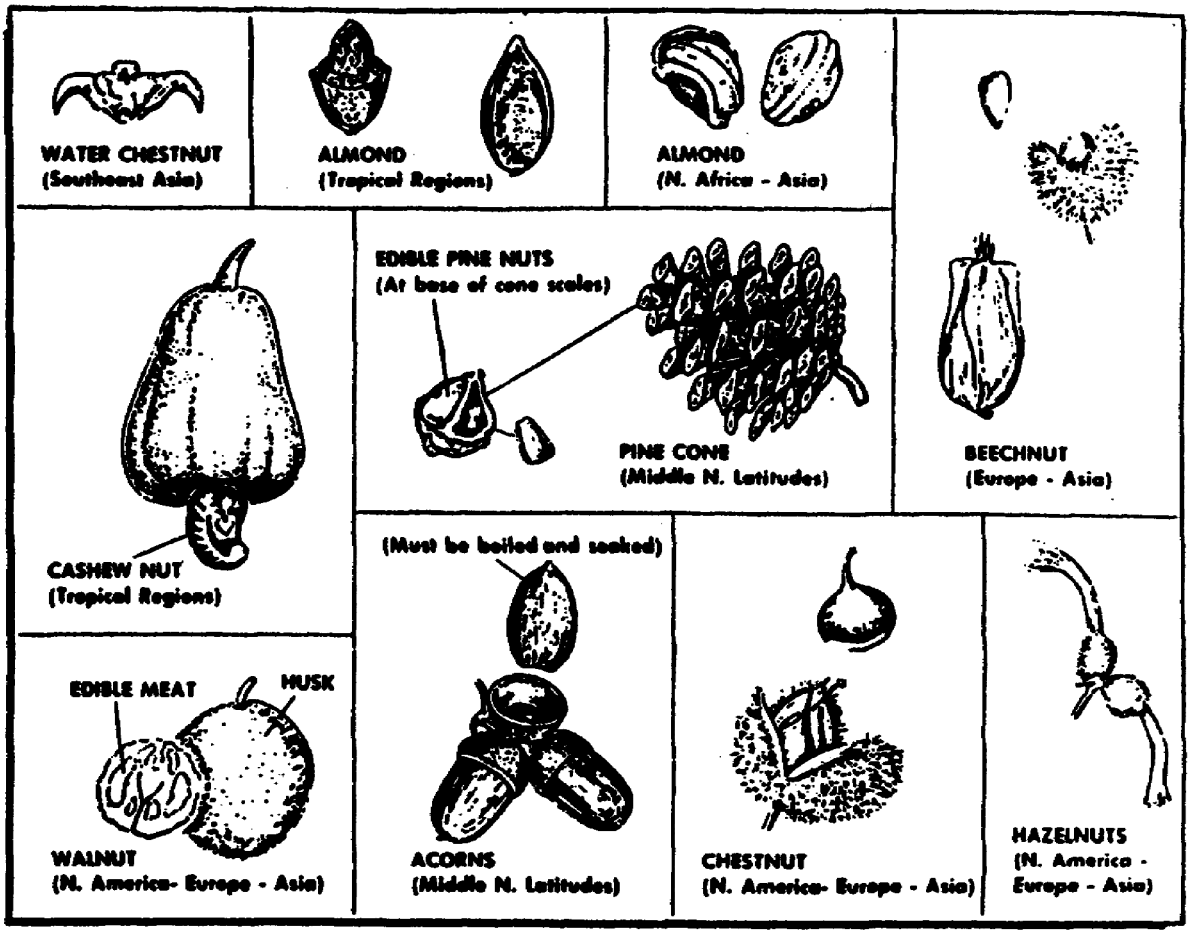


Figure 44. Edible nuts.

pine	buri palm	filbert (hazelnut)
walnut	coconut palm	english oak (acorn)
almond	fishtail palm	indian or tropical almond
beechnut	wild pistachio	water chestnut (trapa nut)
sago palm	jackfruit seeds	
sugar palm	mountain chestnut	

Figure 45. Edible nut plants.

(e) Pulps. The pulp around the seeds of many fruits is the only part that can be eaten. Some fruits produce sweet pulp; others have a tasteless or even bitter pulp. Plants that produce edible pulp include breadfruit, inga pod, tamarind, and custard apple. The pulp of breadfruit must be cooked; whereas, in other plants the pulp may be eaten uncooked. Whenever in doubt, use the edibility rules.

(5) Gums and resins. Gum and resin are sap that collects and hardens on the outside surface of the plant. If it is soft and soluble, it is called gum and resin if it is hard and not soluble. Most people are familiar with the gum that exudes from cherry trees and the resin that seeps from pine trees. These plant byproducts are edible and are good sources of nutritious food; they should not be overlooked.

(6) Saps. Vines or other plant parts may be tapped as potential sources of usable liquid. Obtain the liquid by cutting the flower stalk and letting the fluid drain into some sort of container, such as a bamboo section. Palm sap with its high sugar content is highly nutritious. Plants with edible sap and drinking water are listed in Figure 46.

WATER SOURCES			SAP SOURCES	
agave	cactus	cuipo tree	nipa palm	sugar palm
grape	saxual	rattan palm	sago palm	coconut palm
banana	colocynth	sweet acacia	buri palm	fishtail palm

Figure 46. Drinkable plant saps.

c. Tropical Climate. The jungle environment has a uniquely favorable condition for plant and animal life. The variety and richness of plant growth in these areas are paralleled nowhere else on the earth. The rainfall is distributed throughout the year and there is a lack of cold seasons. Therefore, plants in the humid regions grow, produce leaves, and flower year round. Some plants grow very rapidly. For instance, the stem of the giant bamboo may grow more than 22 inches in a single day.

(1) Of the 300,000 different kinds of wild plants in the world, a large number of them are found in the tropics and many of them are potentially edible. Very few are deadly when eaten in small quantities. Those that are poisonous may be detected by using the edibility rules. Only a small number of jungle plants are discussed here. You can obtain a great benefit by studying the plant foods available in the tropical environment you may be flying over or passing through.

(2) You are lucky to find a plant that can be readily identified as edible. When you search for plant food, apply some basic principles to

the search. If a plant resembles a known plant, it is very likely to be of the same family and can be used. If a plant cannot be identified, apply the edibility test. You may find many edible plants in the tropical forest, but chances of finding them in abundance are better in an area that has been cultivated in the past (secondary growth).

(a) Citrus fruit trees may be found in uncultivated areas but are primarily limited to areas of secondary growth. Many citrus fruit tree and shrub varieties have leaves 2 to 4 inches long arranged alternately. The leaves are leathery, shiny, and evergreen. The leaf stem is often winged. Small (usually green) spine are often present by the side of the bud. The flowers are small and white to purple in color. The fruit has a leathery rind with numerous glands and is round and fleshy with several cells (fruit sections or slices) and many seeds. The great number of wild and cultivated fruits (oranges, limes, and lemons) native to the tropics are eaten raw or used in beverages.

(b) Taro can be found in secondary growth and in virgin areas. It is usually found in the damp, swampy areas of the wild, but certain varieties can be found in the forest. You can identify it by the large heart-shaped or arrowhead-shaped leaves growing at the top of a vertical stem. The stem and leaves are usually green and rise a foot or more from a tuber at the base of the stem. Taro leaf tips point down; poisonous elephant ear points up. All varieties of taro must be cooked to break down the irritating crystals in the plant.

(c) Wild pineapple can be found in the wild, and common pineapples may be found in secondary growth areas. The wild pineapple is a coarse plant with long, clustered, sword-shaped leaves with sawtoothed edges. The leaves are spirally arranged in a rosette. Flowers are violet or reddish. The wild pineapple fruit is not as fully developed in the wild state as when cultivated. The seeds from the flower of the plant are edible as well as the fruit. The ripe fruit may be eaten raw, but the green fruit must be cooked to avoid irritation. (The leaf fibers make excellent lashing material, and ropes can be manufactured from it.)

(d) Yams may be found cultivated or wild. There are many varieties of yam, but the most common has a vine with a square-shaped cross section and two rows of heart-shaped leaves growing on opposite sides of the vine. Follow the vine to the ground to locate the tuber. Cook the tubers to destroy the poisonous properties of the plant (Figure 47).

(e) Ginger grows in the tropical forest and is a good source of food flavoring. The ginger plant is found in shaded areas of the primary forest and grows 5 to 6 feet high. It has seasonal white snapdragon-type flowers; some variations have red flowers. When the leaves are crushed, they produced a very sweet odor and are used for seasoning or tea. The tea is used by primitive people to treat colds and fever.

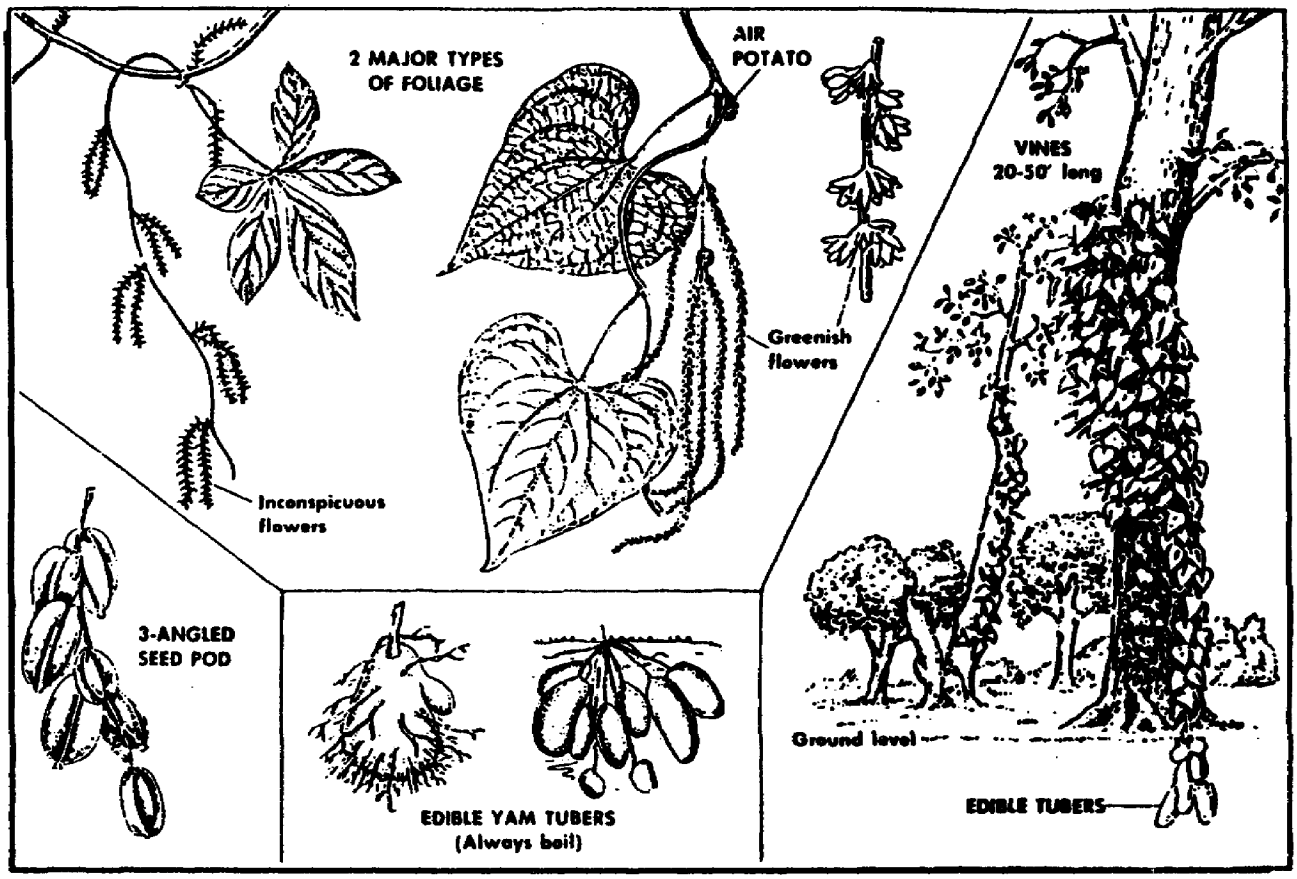


Figure 47. Yams.

(f) The coconut palm is found wild on the seacoast and in farmed areas inland. It is a tree 50 to 100 feet high, either straight or curved, and marked with ring-like leaf scars. The base of the tree is swollen and surrounded by a mass of rootlets. The leaves are leathery and reach a length of 15 to 20 feet (they make excellent sheathing for shelter). The fruit grows in clusters at the top of the tree. Each nut is covered with a fibered hard shell. The heart of the coconut palm is edible and is also found at the top. (The new leaves grow out of the heart.) Cut the tree down and remove the leaves to gain access to the heart. The flower of the coconut tree is also edible and is best used as a cooked vegetable. The germinating nut is filled with a meat that can be eaten raw or cooked. Many other varieties of palm found in the tropics have edible hearts and fruits (Figure 48).

(g) The papaya is an excellent source of food and can be found in secondary growth areas. The tree grows to a height of 6 to 20 feet. The large, dark green, many fingered, rough-edged leaves are clustered at the top of the plant. The fruit grows on the stem clustered under the leaves. The fruit is small in the wild state, but cultivated varieties may grow to 15 pounds. The peeled fruit can be eaten raw or cooked; NEVER eat the peeling. The green fruit is usually cooked, and the milky sap of the green fruit is used as a meat tenderizer. Take care not to get the sap in your eyes--always wash your hands after handling fresh

green papayas. It some of the sap does get in the eyes, they should be washed immediately (Figure 49).

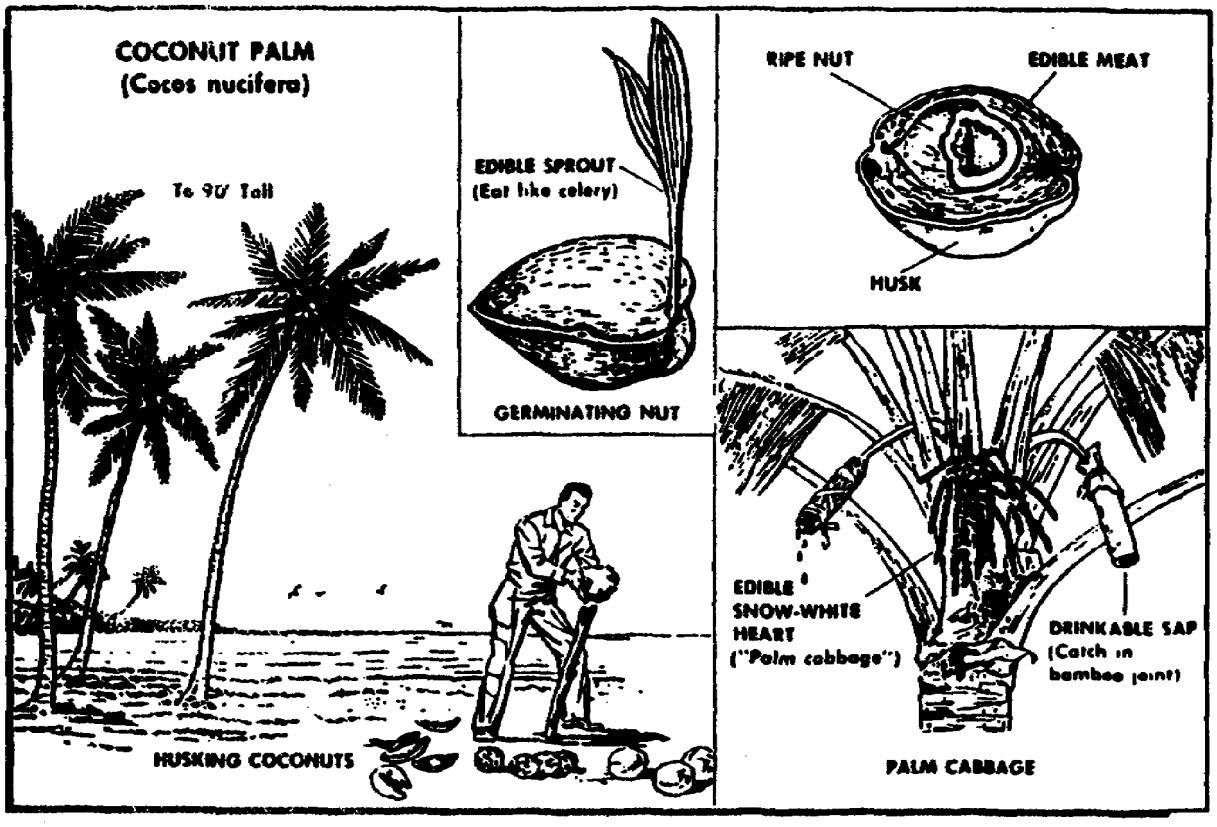


Figure 48. Coconut palm.

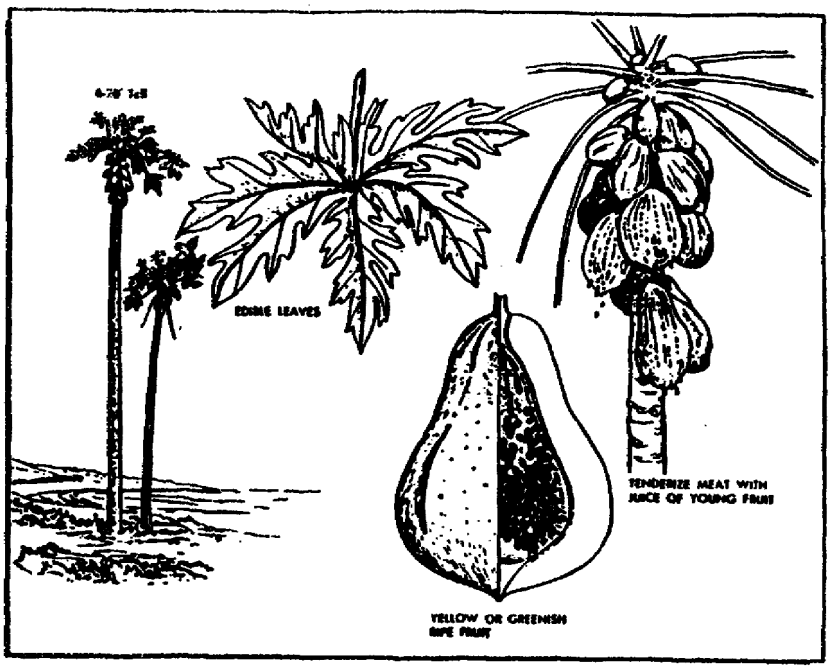


Figure 49. Papaya.

(h) Cassava (tapioca) can be found in secondary growth areas. You can identify it by the stalk-like leaves that are deeply divided into numerous pointed sections or fingers. The woody (red) stem of the plant is slender and, at points, appears to be sectioned. When found growing wild in secondary growth areas, pull the trunks to find a root, and dig the tuber. Tubers have been found growing around a portion of the stem that was covered with vegetation. The brown tuber of the plant is white inside and must be boiled or roasted. The tuber must also be peeled before boiling. (The green-stemmed species of cassave is poisonous and must be cooked in several changes of water before eating it.)

(i) Ferns can be found in the virgin tropical forest or in secondary growth areas. The new leaves (fiddleheads) at the top are edible. They are covered with fuzzy hair that is easily removed by rubbing or washing. Some can be eaten raw but, as a rule, should be cooked as a vegetable (Figure 50).

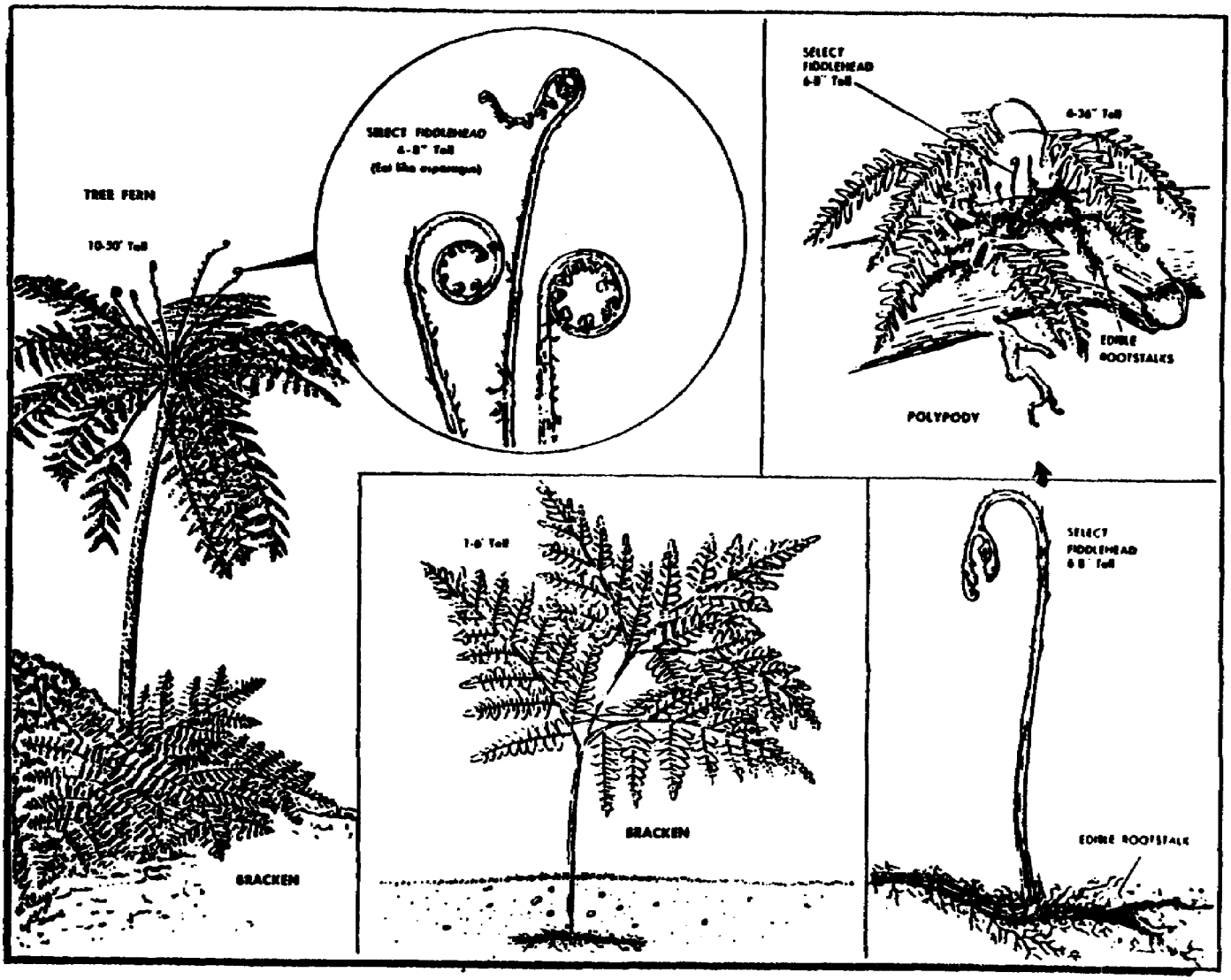


Figure 50. Edible ferns.

(j) Sweetsops can be found in the tropical forest. It is a small tree with simple, oblong leaves. The fruit is shaped like a blunt pine cone with thick, brittle, grey-green or yellow spines. The fruit is easily split or broken when ripe to expose numerous dark brown seeds imbedded in the cream colored, very sweet pulp.

(k) The star apple tree, common in the tropical forests, grows to a height of 60 feet. You can identify it by the shiny, silky, brown hairs on the bottom of the leaves. The fruit looks like a small apple or plum with a smooth greenish or purple skin. The meat has a greenish color and a milky texture. When cut through the center, the brown, elongated seeds make a figure like a 6-or 10-pointed star. The fruit is sweet and should be eaten only then fresh. When cut, the rind, like other parts of the tree, emits a white sticky juice or latex which is not poisonous (an exception to the milky sap rule).

d. Desert Climates. Although not as readily available as in tropical climates, food is available and obtainable in desert climates. Plant life in the desert is varied due to the different geographical areas. Remember that available plants depend on the actual desert; the time of year, and if there has been any recent rainfall. Familiarize yourself with the plants in the area you will fly over.

(1) Date palms, located in most deserts, are cultivated by the native people around oases and irrigation ditches. When ripe they bear a nutritious, oblong, black fruit.

(2) Fig trees are normally located in tropical and subtropical zones; however, a few species can be found in the deserts of Syria and Europe. Many are cultivated. Eat the fruit when ripe. Most figs resemble a top or a small pear somewhat squashed in shape. Ripe figs vary greatly as to palatability. Many are hard, woody, covered with irritating hairs, and worthless as survival food. The edible varieties are soft, delectable, and almost hairless. They are green, red, or black when ripe.

(3) Millet is grown by natives around oases and other water sources in the Middle East deserts. This plant produces an edible grain.

(4) The fruit of all cacti are edible. Some fruits are red, some yellow; all are soft when ripe. Any of the flat leaf variety (prickly pear) can be boiled and eaten as greens (like spinach) after first removing the spines. During severe droughts, cattlemen burn off the spines and use the thick leaves for fodder. Although the cactus originates in the American deserts, the prickly pear has been introduced to the desert edges in Asia, Africa, the Near East, and Australia where it grows profusely. Natives eat the fruit as fast as it ripens.

(5) There are two types of onions in the Gobi desert. A hot, strong, scallion-type grows in the late summer. It improves the taste of food but should not be used as a primary food. The highland onions grow 2

to 2.5 inches in diameter. These are eaten like apples, and the greens are eaten raw or cooked.

(6) All grasses and grass seeds are edible. Usually the best part of grasses is the whitish tender end that shows when the grass stalk is pulled from the ground. All desert flowers can be eaten except those with milky or colored sap.

e. Arctic Climates. The plant life of the arctic regions is generally small and stunted. The effects of permafrost, low mean temperatures, and a short growing season cause this to happen. However, some edible plant life is found throughout the year in most areas of the arctic.

(1) On the barren tundra, a wide variety of small edible plants and shrubs exists. During the short summer months, you can find fireweed, willows, coltsfoot, Labrador tea, dwarf arctic birch, and numerous other plants and berries. During the winter, you can find roots, rootstalks, and frozen berries beneath the snow. Lichens and mosses are abundant but should be selected carefully as some species are poisonous.

(2) In bogs or swamps many types of cattail, berries, dwarf birch, and water sedge are available. During spring and summer, you can easily collect many young shoots from these plants.

(3) The wooded areas of the arctic contain a variety of trees (birch, spruce, poplar, aspen, and others). Many berry-producing plants are found, such as blueberries, cranberries, raspberries, cloud berries, and crowberries. Alder, wild rose hips, Labrador tea, and other shrubs are very abundant. Many wild edible plants are highly nutritious. Greens are particularly rich in carotene (vitamin A). Leafy greens, many berries, and rose hips are all rich in ascorbic acid (vitamin C). Many roots and rootstalks contain starch and are used as a potato substitute in stews and soups.

(4) There are several types of edible fungi, mushrooms, and puffballs in the arctic. However, you should avoid ingesting them because it is difficult to identify the poisonous and nonpoisonous species. During the growing season, physical characteristics can change considerably making positive identification even more difficult.

(5) There are many poisonous plants and a few poisonous berries in the arctic. Very few cause death; many cause extreme nausea, dizziness, abdominal pain, and diarrhea. Contact poisonous plants (poison ivy) are not found in the arctic. The more common poisonous plants are shown in Figures 32 through 34.

(6) When selecting edible plants, select young shoots when possible as these are the most tender. Eat plants raw to obtain the most nutritive value. Some of the more common edible plants include those listed below.

(a) Dandelions generally grow with grasses, but they may be scattered over rather barren areas. Leaves and roots are edible either raw or cooked. The young leaves make good greens; the roots (when roasted) are used as a substitute for coffee.

(b) Black and white spruce are generally the northern most evergreens. These trees have short, stiff needles that grow singularly rather than in clusters like pine needles. The cones are small and have thin scales. Although the buds, stems, and needles have a strong resinous flavor, they provide essential vitamin C when eaten raw. In spring and early summer, the inner bark also is used for food.

(c) The dwarf arctic birch is a shrub with thin tooth-edged leaves and bark that peels off in sheets. The fresh green leaves and buds are rich in vitamin C. You may also eat the inner bark.

(d) There are many different species of willow in the arctic. You may eat the young tender shoots as greens and the bark of the roots. They have a decidedly sour taste but contain a large amount of vitamin C (Figure 51).

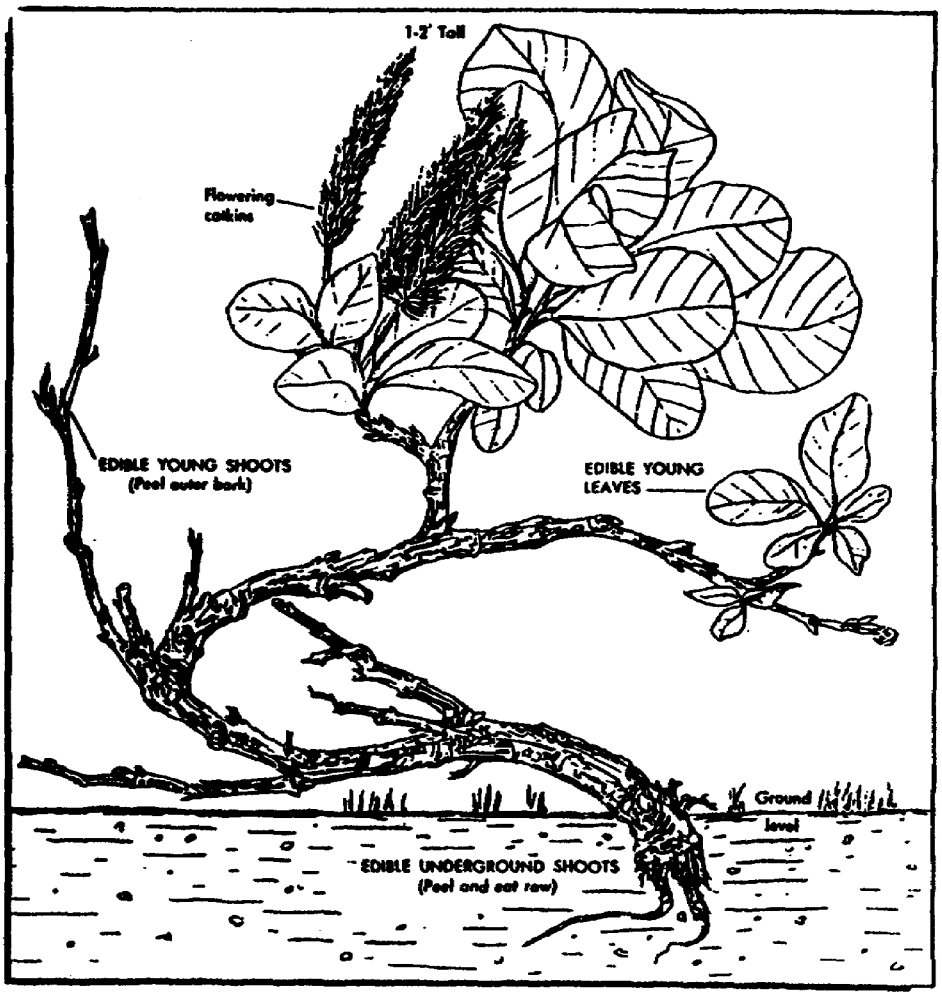


Figure 51. Arctic willow.

(7) Lichens are abundant and widespread in the far North and are used as a source of emergency food. Many species are edible and rich in starch-like substances. These include Iceland moss, peat moss, and reindeer lichen. Bear lichen, used as food by Indians, grows on trees. However, some of it contains a bitter acid that causes irritation of the digestive tract. If lichens are boiled, dried, and powdered, this acid is neutralized. The powder is then used as flour or made into a thick soup.

11. AQUATIC FOOD SOURCES

Almost all sea life is not only edible but also an excellent source of nutrients essential to humans. The protein is complete because it contains all the essential amino acids; the fats are similar to those of vegetables. Seafoods are high in minerals and vitamins. Life in the sea includes fish, birds, plants, and aquatic animals. During the summer months, the open water provides an excellent opportunity to procure all types of freshwater and saltwater fish and freshwater mussels. Even if the surface freezes, fishing is still possible through the ice. Shallow lakes, ponds, or rivers can freeze completely killing off all fish life. Fish tend to congregate in the deepest water possible. Cut a hole through the ice at the estimated deepest point. Other good locations are at outlets or where tributaries flow into lakes or ponds. The ice is normally thinner over rapid moving water and at the edges of deep streams or rivers with snowdrifts extending out from the banks. Open water is often marked by a mist or fog formed over the area by vaporizing water. All methods of procuring fish in the summer will work in the winter. Tidal pools usually contain a great number of fish and mollusks. The fish can be netted, speared, or hand caught. Seafood such as fish, crabs, lobsters, crayfish, and small octopi can be poked out of holes, crevices, or rock pools. Be ready to spear them before they move off into deep water. If they are in deeper water, they can be teased shoreward with a stick or baited hook. All sea life can be eaten raw, but cooking makes it more palatable (Figure 52).

a. Fish. Fishing is an energy efficient method to get food throughout the year wherever water is found. Like other cold blooded creatures, fish confine their activities to areas where they can maintain an optimum body temperature. Fish seek refuge in the deepest water during periods of extreme temperature changes. In shallow streams, the best places to find fish are pools below falls, the foot of rapids, or behind rocks (Figure 53). Mangrove swamps are often good fishing grounds. In lakes or large streams, fish tend to approach the banks and shallows in the morning and evening. Sea fish, traveling in large schools, regularly approach the shore with the incoming tide. They often move parallel to the shore guided by an obstruction in the water. Small fish usually gather under the shadow of a raft or in clumps of floating seaweed. These fish can be eaten or used as bait for larger fish. The safest fish to eat are those from the open sea or deep water beyond the reef. Silvery fishes, river eels, butterfly fishes, and flounders from bays and rivers are good to eat. At low tide, clusters of oysters and mussels are exposed on the mangrove "knee" or lower branches. Mussels can be handpicked off the bottom of pools, while fish

can be netted, speared, clubbed, or caught with a hook and line. Clams are found in the mud at the base of trees. Crabs are very active among branches or roots and in the mud. Snails are found on mud and clinging to roots. Do NOT eat shellfish that are not covered at high tide. Some indications of diseased shellfish include shells that gape open at low tide, a foul odor, or milky juice coming from them. Avoid strange looking fish and fish with flesh that remains indented when depressed as it is probably becoming spoiled and should not be eaten. You can use a net to procure most all sea life. Light attracts some types of fish. A flashlight or reflected moonlight can be used. If you are in a raft, it is not advisable to secure fishing lines to the body of the raft because a large fish may pull a person out of the raft or damage the raft. Fish, bait, or bright objects dangling in the water attract large dangerous fish. Kill all large fish outside the raft by a blow to the head or by cutting off the head. The many ways to catch fish include hook and line, gill nets, poisons, traps, and spearing.

Figure 52. Shell fish.

(1) Hook and line.

(a) If an emergency fishing kit is available, there is a hook and line in it; if a kit is not available, a hook and line will have

to be improvised. Hooks are made from wire or carved from bone or wood. The line is made by unraveling a parachute line or by twisting threads from clothing or plant fibers. A piece of wire between the fishing line and the hook helps prevent the fish from biting through the line. Worms, meat, insects, shellfish, or smaller fish are used as bait. Select bait by observing what the fish are eating. You can make artificial lures with feathers, pieces of brightly colored cloth, or bits of bright metal or foil tied to a hook. If the fish does not take the bait, try to snag or hook them in any part of the body as they swim by. Be patient and fish at different depths in all kinds of water. Fishing at different times of the day and changing bait is often productive.

Figure 53. Fishing places.

(b) Hook-and-line fishing on a rocky coast requires a lot of care to keep the line from becoming entangled or cut on sharp edges. Most shallow-water fish are nibblers. Unless the bait is-well placed and hooked and the barb of the hook offset by bending, the bait may be lost without catching a fish. Use snails, hermit crabs, or the tough muscle of a shellfish as bait. Take the cracked shells and any other animal remains and drop them into the area to be fished. This attracts fish to your area and may increase your chances of success. Examine stomach contents of the first fish caught to determine what the fish are feeding on.

(c) Jigging is a form of hook-and-line fishing. Use a baited or spooned hook and dip it repeatedly beneath the surface of the water. This method may be used at night and is sometimes effective.

(2) Nets.

(a) An extremely effective fishing tool is a net. A net catches fish without having to be attended (Figures 22 and 54). If a gill net is used, stones can be used for anchors and wood for floats. Set the net at a slight angle to the current. This clears the net of any floating refuse that comes down the stream. Check the net at least twice daily (Figure 55). A net with poles attached to each end works effectively if moved up or down a stream as rapidly as possible. Do this while moving stones and threshing the bottom or edges of the streambanks. Check the net every few moments so the fish cannot escape.

(b) A hand net made from parachute cloth or other material is excellent for catching shrimp. Shrimp (prawns) live on or near the sea bottom and may be scraped up. They may be lured to the surface with light at night. Lobsters are creeping crustaceans also found on or near the sea bottom. A jig, dip net, lobster trap, or baited hook can be used to catch lobsters. Crabs creep, climb, and burrow and are easily caught in shallow water with a dip net or in traps baited with fish heads or animal viscera.

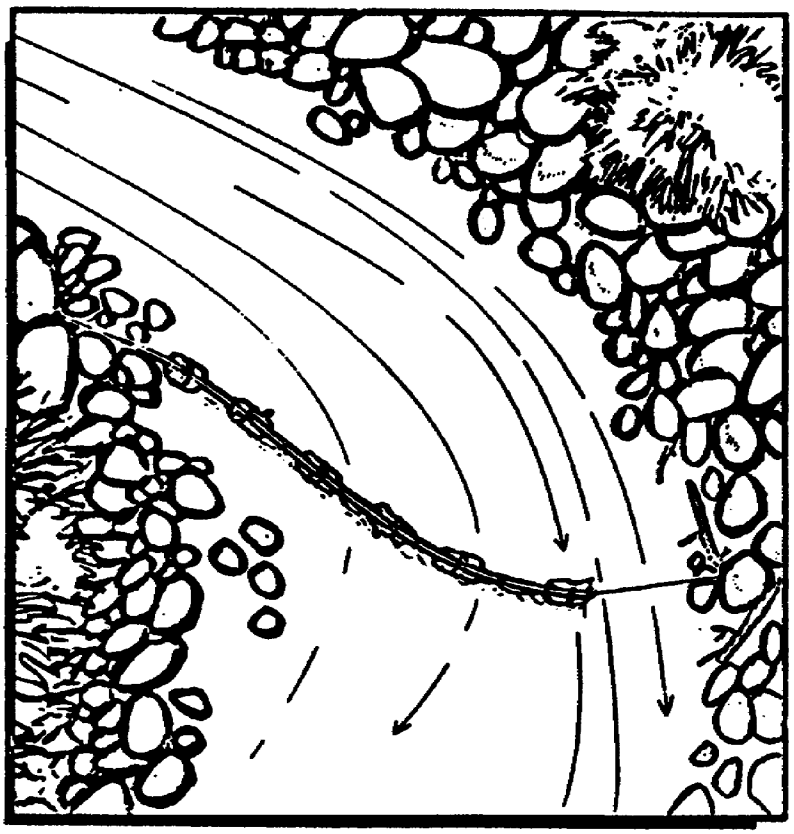


Figure 54. Setting the gill net.

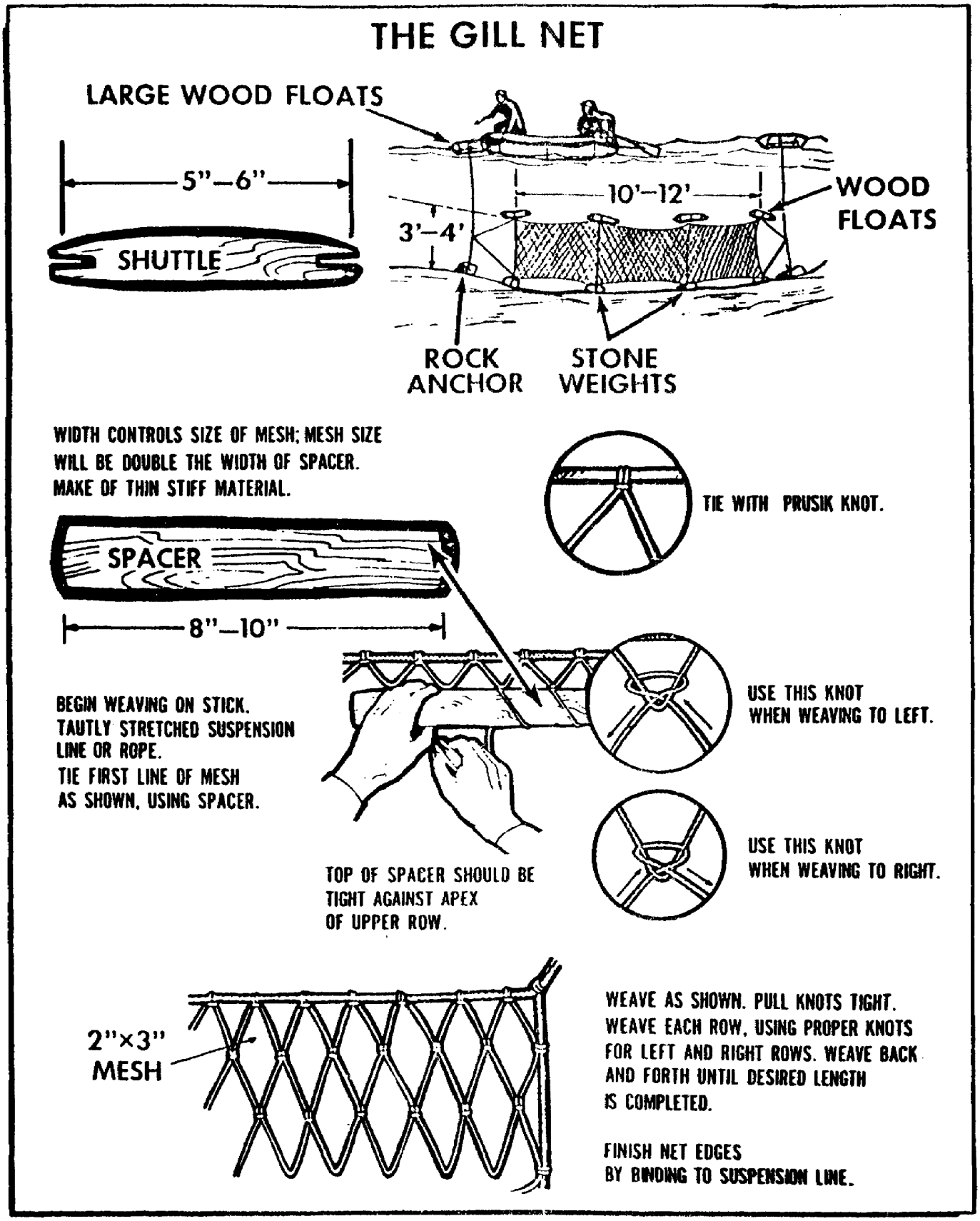


Figure 55. Making a gill net with shuttle and spacer.

(3) Poisons. Throughout the warm regions of the world there are various plants the natives use for poisoning fish. The active poison in these plants is harmful only to cold-blooded animals. Survivors can eat fish killed by this poison without ill effects. The most common method of using fish-poison plants is to crush the plant parts (most often the roots) and mix them with water. Drop large quantities of the crushed plant into pools or the headwaters of small streams containing fish. Within a short time, the fish rise in a helpless state to the surface. After putting in the poison, follow slowly downstream and pick up the fish as they come to the surface, sink to the bottom, or swim crazily to the bank. A stick dam or obstruction aids in collecting fish as they float downstream.

(a) In Southeast Asia, the derris plant is widely used as a source of fish poison. The derris plant, a large woody vine, is also used to produce a commercial fish poison called rotenone.

(b) The husk of "green" black walnuts can be crushed and sprinkled into small sluggish streams and pools. The material acts as a fish stupefying agent.

(c) In the southwest Pacific, the seeds and bark from the barringtonia tree (Figure 56) are commonly used as sources of fish poison. This tree usually grows along the seashore.

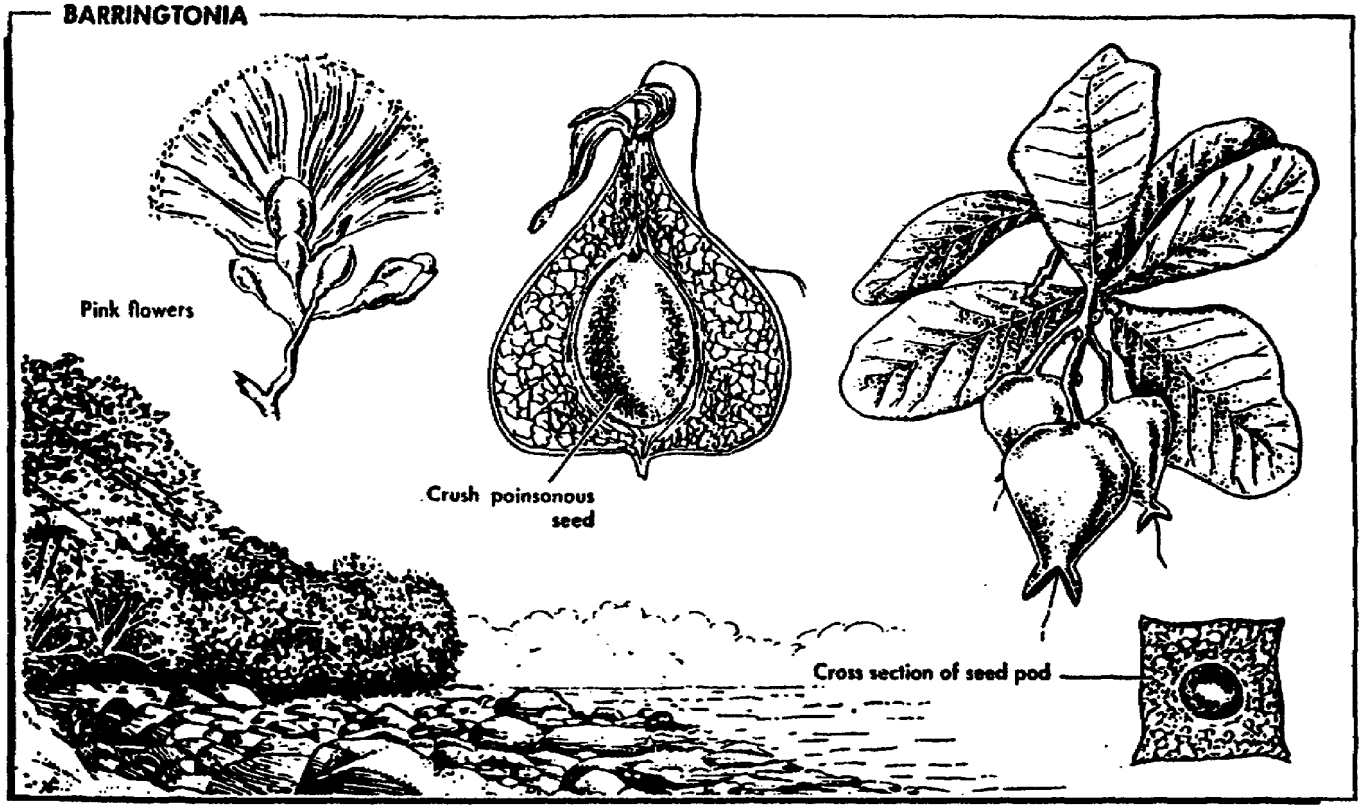


Figure 56. Barringtonia plant for poisoning fish.

(d) Lime thrown in a small pond or tidal pool kills fish in the pool. You can obtain lime by burning coral and seashells.

(e) Commercial rotenone is used in the same manner as crushed derris roots. It causes respiratory failure in fish but has no ill effects on humans. A small container of 12 percent rotenone (1/2 ounce) is a valuable addition to any emergency kit. An ounce of 12 percent rotenone can kill every fish for a half mile down a slow-moving stream that is about 25 feet wide. Do not expose it unnecessarily to air or light. It retains its toxicity best if kept in a dark-colored vial. Rotenone should be mixed to a malted-milk consistency with a little water and then distributed in the water. If the concentration is strong, it takes effect within two minutes in warm water; it may take an hour in colder water. Rotenone is very swift acting in warm water at 70 degrees Fahrenheit (OF) and above. It works more slowly in cold water and is not practical in water below 550F. Rotenone is best applied in small ponds, streams, or tidal pools. Fish sick enough to turn over on their backs eventually die. Using too much rotenone is a waste; however, too little will not be effective.

(4) Traps.

(a) Fish traps (Figure 57) are very useful for catching freshwater and saltwater fish, especially those that move in schools. A fish trap is basically an enclosure with a blind opening where two fencelike walls extend out, like a funnel, from the entrance. The time and effort put into building a fish trap depends on the need for food and the length of time survivors plan to stay in one spot. Select the trap location at high tide and build the trap at low tide. One to two hours of work should do the job. Consider the location and try to adapt natural features to reduce your labor. Use natural rock pools on rock shores. On coral islands use natural pools on the surface of reefs by blocking the opening as the tide recedes. On sandy shores use sandbars and the ditches they enclose. The best fishing off sandy beaches is the lee side of offshore sandbars.

(b) By watching the swimming habits of fish, you can build a simple dam that extends into the water forming an angle with the shore. This traps fish as they swim in their natural path. When planning a more complex brush dam, select protected bays or inlets using the narrowest area and extending one arm almost to the shore.

(c) In small, shallow streams, make fish traps with stakes or brush. The material is set into the stream bottom or weighted down with stones so that the stream is blocked except for a small narrow opening into a stone or brush pen or shallow water. You then wade into the stream, herding the fish into the trap, and catch or club them when they get in shallow water. Freshwater crawfish and snails are found under rocks, logs, overhanging bushes, or in mud bottoms. Trample mud-bottom streams until cloudy. This blinds the fish, and they cannot avoid the nets.

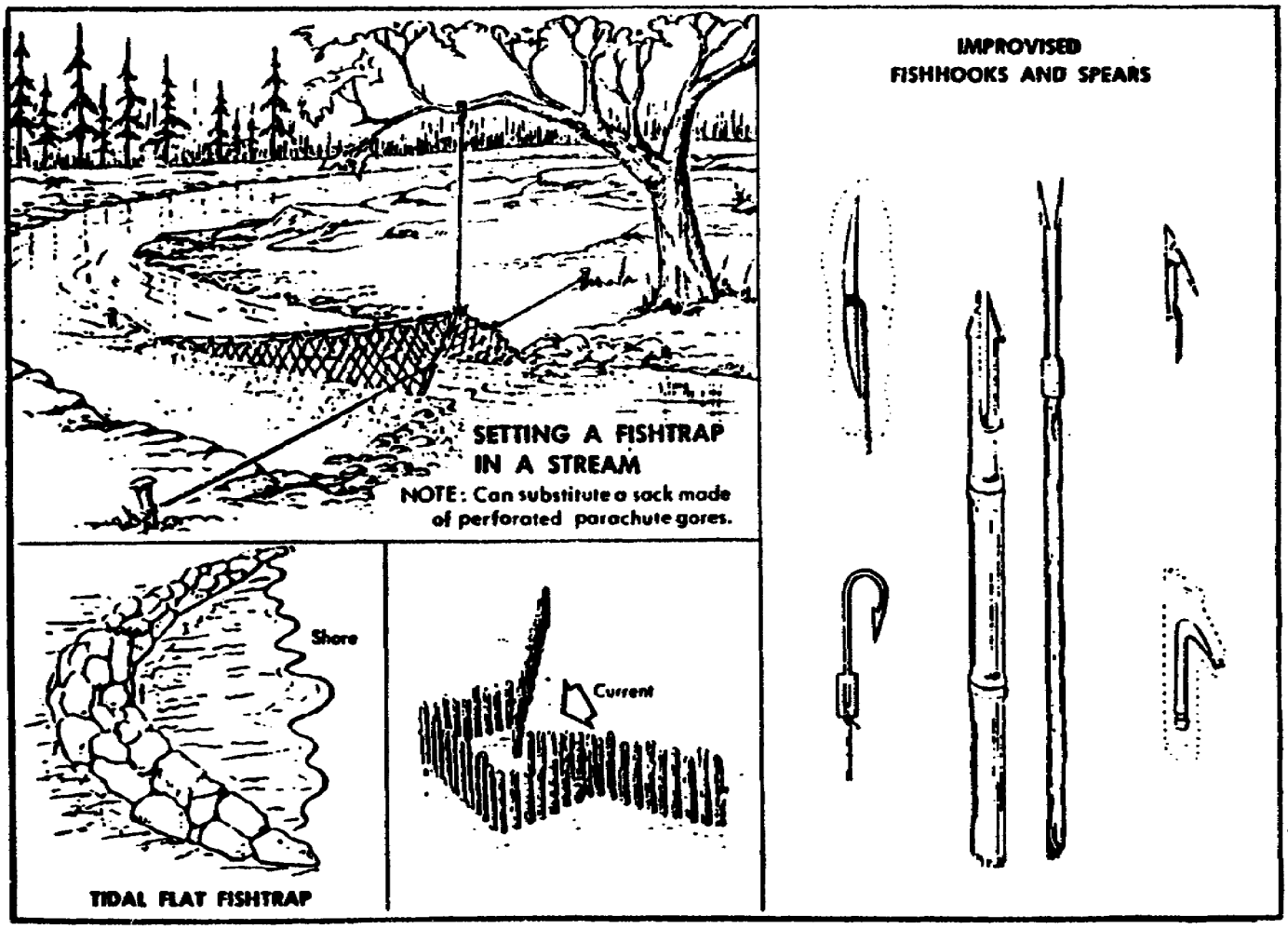


Figure 57. Maze-type fish traps.

(d) Kill only those fish that you plan to eat immediately. Confine fish for future consumption in an enclosure that allows a free exchange of fresh water.

(e) Tickling is effective when catching fish in small streams with undercut banks or in shallow ponds left by receding flood waters. Place your hands in the water, and slowly reach under the bank. Keep your hands close to the bottom if possible. Move your fingers slightly until they make contact with a fish. Then gently work your hands along its belly until reaching its gills. Grasp the fish firmly Just behind the gills, and scoop it onto land. In the tropics, this type of fishing can be dangerous because of the hazardous aquatic life (piranhas, eels, and snakes) in the water.

(f) Chop fishing is effective at night during low tide. This method requires a torch and a machete. The fish are attracted by the light of the torch, and then are stunned by slashing at them with the back of the machete blade. Of course, take care when swinging the machete (Figure 58).

Figure 58. Chop fishing.

(5) Spears. Make a spear by sharpening a long piece of wood, lashing two long thorns on a stick, or fashioning a bone spear point. You then take a position on a rock over a fish run and wait patiently and quietly for a fish to swim by before spearing. Spearing is difficult except when the stream is small and the fish are large and numerous during the spawning season or when the fish congregate in pools.

b. Invertebrates. The ocean shores are rich hunting grounds for edible invertebrate sea life (Figure 59), such as clams, snails, crabs, mussels, limpets, chitons, sea urchins, and sea cucumbers. They can be procured most of year wherever there is open water. Land crabs are common on tropical islands and are often found in coconut groves. Use an open coconut for bait.

(1) In the numerous basins of the Sonora and Chihuahua deserts, several species of freshwater shrimp appear every summer in warm temporary ponds. In the Mohave Desert, where summer rains are rare, they may appear only a few times in a century.

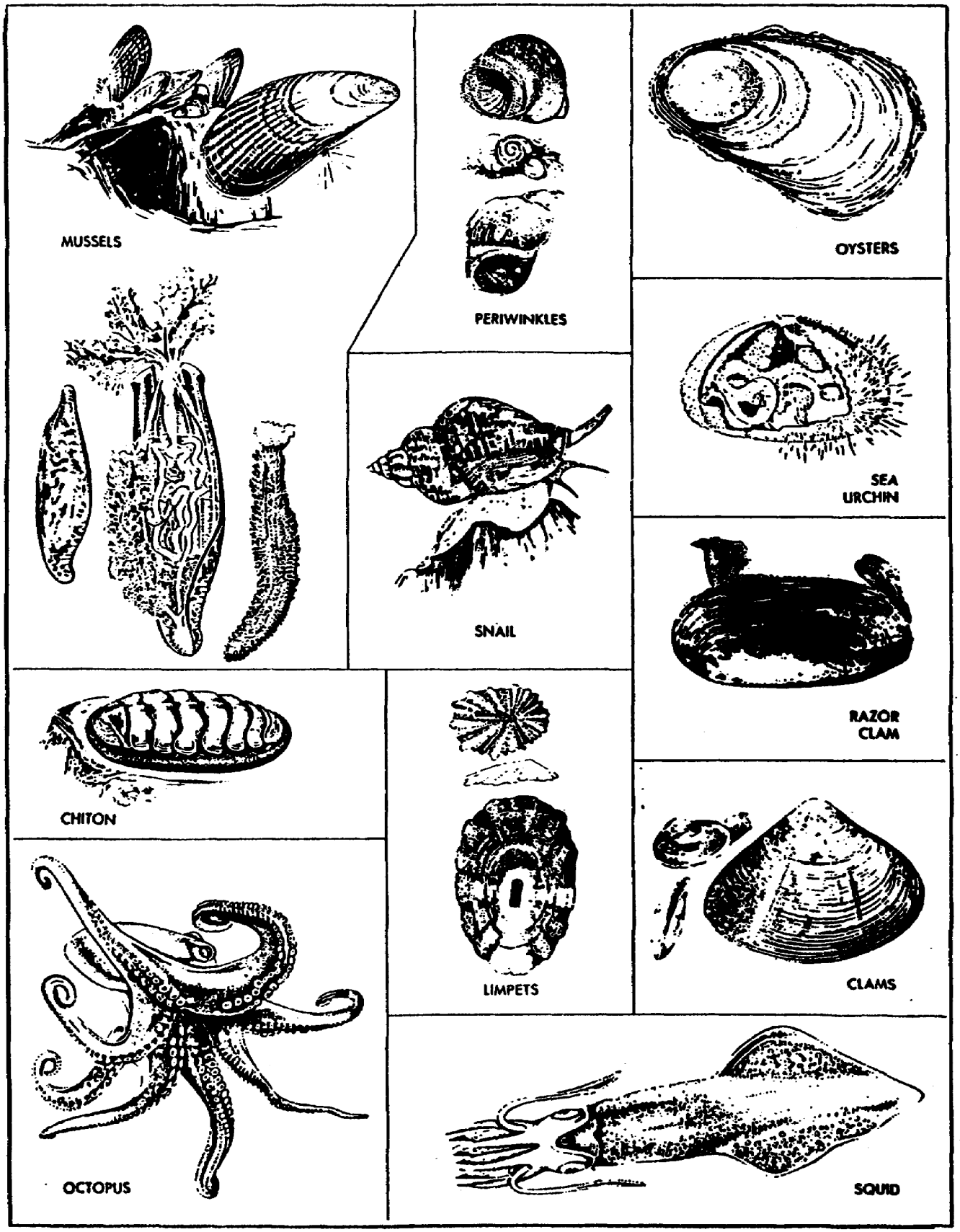


Figure 59. Edible invertebrates.

(2) Snails and limpets cling to rocks and to seaweed above and at the low-water mark. Large snails called chitons adhere tightly to rocks just above the surfline.

(3) Sluggish sea cucumbers and conchs (large snails) live in deep water. When excited the sea cucumber shoots out its stomach which is not edible; however, the skin and the five strips of muscle can be eaten after boiling. Conchs have very firm flesh and car be boiled out of their shells. Use care when picking up conchs. The bottom of their "foot" has a boney covering that can severely cut the survivor who handles it.

(4) Mussels usually form dense colonies in rock pools, on logs, or at the bases of boulders. Mussels are poisonous in tropical zones during the summer, especially when seas are highly phosphorescent or reddish.

(5) A small heap of empty oyster shells near a hole may indicate the presence of an octopus. A baited hook placed in the hole will often catch the octopus. You should allow the octopus to surround the hook and line before lifting it. Octopi are not scavengers like sharks, but they are hunters. Octopi are fond of spiny lobster and other crab-like fish. At night, they come into shallow water and are easily seen and speared.

c. Birds. Sea birds, proven to be a useful food source, may be more easily caught than fish. Survivors have reported capturing birds by grabbing, shooting, and using baited hooks. Skin, rather than pluck, freshly killed birds to remove the oil glands. Eat them either raw or cooked or preserve them immediately after cleaning. The gullet contents are also a good food source. The viscera, along with any other unused parts, makes good fish bait.

d. Aquatic animals. Marine mammals are rarely encountered by a person in the water, although they may be seen from a distance. Any large mammal is capable of inflicting injuries. Unless such mammals are pursued, they generally avoid people. The killer whale (Orca) is rarely seen and, although large enough, has never been known to feed on humans. Almost all sea mammals are good sources of food but difficult to obtain. Do NOT eat the liver, especially that of any arctic or cold-water mammal, because of toxic concentrations of vitamin A.

e. Plants. Most seaweeds are edible and good sources of food, especially for vitamins and minerals. Some seaweeds contain as much as 25 percent protein, while others are composed of over 50 percent carbohydrates. At least 75 different species are used for food by seacoast residents around the world. For many people, especially the Japanese, seaweeds are an essential part of the diet. The most popular varieties have been successfully farmed for hundreds of years. The high cellulose content may require gradual adaptation because of its laxative quality if it comprises a large part of the diet. As with vegetables, some species are more flavorful than others. Generally, leafy green, brown, or red seaweeds can be washed and eaten raw or dried. A description of edible seaweeds below tells

where they may be found and, in many cases, suggests a method of preparation.

(1) Common green seaweeds (Figure 60), often called sea lettuce (Ulva lactuca), are abundant on both sides of the Pacific and North Atlantic oceans. After washing it in clean water, use it as a garden lettuce.

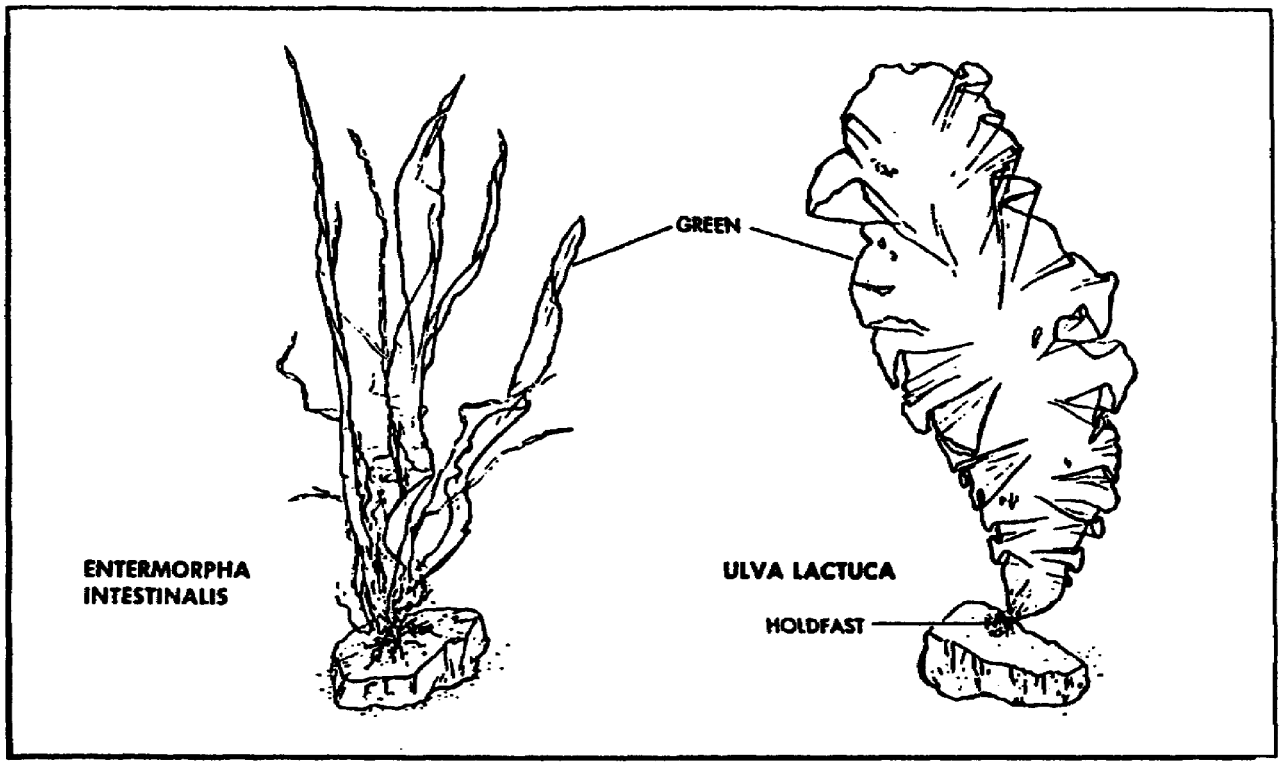


Figure 60. Edible green seaweeds.

(2) The most common edible brown seaweeds are the sugar wrack, kelp, and Irish moss (Figure 61). The young stalks of the sugar wrack are sweet to taste. This seaweed is found on both sides of the Atlantic and on the coasts of China and Japan. Edible kelp has a short cylindrical stem and thin, wavy, olive-green or brown fronds 1 to several feet in length. It is found in the Atlantic and Pacific oceans, usually below the high-tide line on submerged ledges and rocky bottoms. Boil kelp before eating. It can be mixed with vegetables or soup. Irish moss, a variety of brown seaweed, is quite edible and often sold in market places. It is found on both sides of the Atlantic Ocean and identified by its tough, elastic, and leathery texture. However when dried, it becomes crisp and shrunken. It should be boiled before eating. It is found at or just below the high-tide line. Sometimes it is found cast upon the shore.

(3) Red seaweeds are usually identified by their characteristic reddish tint, especially the edible varieties. The most common and edible red seaweeds include the dulse, laver, and other warm-water varieties (Figure 62).

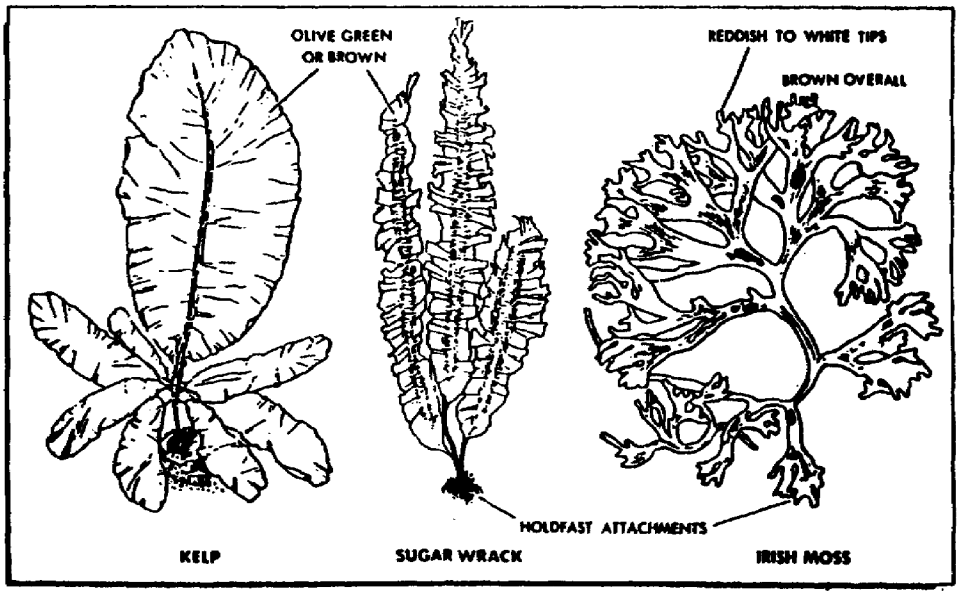


Figure 61. Edible brown seaweeds.

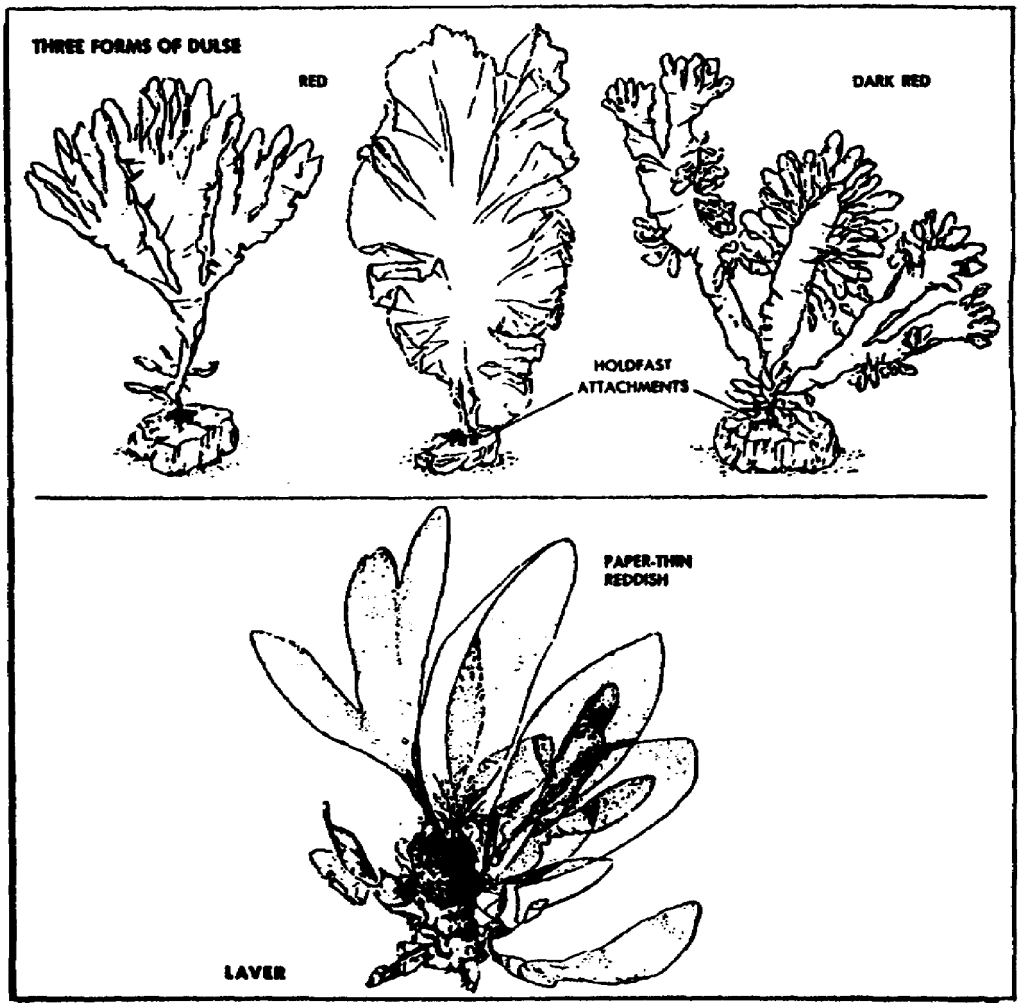


Figure 62. Edible red seaweeds.

(a) Dulse has a very short stem that quickly broadens into a thin, broad, fan-shaped expanse. This fan is dark red and divided by several clefts into short, round-tipped lobes. The entire plant is from a few inches to a foot in length. It is found attached to rocks or coarser seaweeds, usually at the low-tide level, on both sides of the Atlantic Ocean and in the Mediterranean. Dulse is leathery and sweet to taste. If dried and rolled, you can use it as a substitute for tobacco.

(b) Laver (usually red, dark purple, or purplish-brown) has a satiny sheen or filmy luster. Common to the Atlantic and Pacific oceans, it has been used as food for centuries. This seaweed is used as a relish or is cleaned and then boiled gently until tender. It can also be pulverized and added to crushed grains and fried in the form of flatcakes. During World War II, laver was chewed by New Zealand troops for its thirst-quenching value. Laver is usually found on the beach at the low-tide level.

(c) A great variety of red, warm-water seaweed is found in the South Pacific area. This seaweed accounts for a large portion of the native diet. When found on the open sea, bits of floating seaweed may not only be edible but often contains tiny animals that can be used for food. Small fish and crabs can be dislodged from it by shaking the clump of seaweed over a container.

f. Plankton. Plankton includes both minute plants and animals that drift about or swim weakly in the ocean. These basic organisms in the marine food chain are generally more common near land since their occurrence depends on the nutrients dissolved in the water. Plankton can be caught by dragging a net through the water. The taste of the plankton depends on the types of organisms predominant in the area. If the population is mostly fish larvae, the plankton tastes like fish. If the population is mostly crab or shellfish larvae, the plankton tastes like crab or shellfish. Plankton contains valuable fats, protein, and carbohydrates. Because of its high chiton and cellulose content, however, plankton cannot be immediately digested in large quantities. Therefore, anyone subsisting primarily on a plankton diet must gradually increase the quantities consumed. Most of the planktonic algae (phytoplankton) are smaller than the planktonic animals (zooplankton) and, although edible, are less palatable. Some plankton algae, those dinoflagellates that cause "red tides" and paralytic shellfish poisoning, are toxic to humans.

(1) If you are going to use plankton as a food source, there must be a sufficient supply of freshwater for drinking. Examine each catch to remove all stinging tentacles broken from jellyfish or Portuguese man-of-war. The primarily gelatinous species may also be selectively discarded since their tissues are predominately composed of saltwater. When plankton is found in subtropical waters during the summer months and the presence of poisonous dinoflagellates is suspected (because of discoloration or high luminescence of the ocean), apply the edibility test before eating (Figure 26).

(2) The final precaution you may wish to take before ingesting plankton is to feel or touch the plankton to check for species that are especially spiney. Sort (visually) or dry and crush the catch before eating if it contains large numbers of these spiney species.

12. PREPARATION

a. The problem of preparing food in a hostile area becomes acute when a fire, even a small cooking fire, can bring about capture. After finding food in a hostile area, the problem of preparing the food in a manner that does not compromise the survivor's presence must be resolved. Of course, it would be simple to state that the best solution would be to eat the food without cooking it. In some respects, this is a more reasonable solution than it might initially seem to be.

b. With regard to the health considerations involved, many of the reasons for cooking are recognized as a means of destroying organisms that may be present in the food and can cause sickness or ill effects if they enter into the body. Under survival conditions in a hostile area, you may be forced to forego thorough cooking and accept the risk involved until you return to friendly forces where professional treatment is available.

c. Palatability is mostly a matter of adjusting your "frame of mind." Animal foods are recognized as being palatable when cooked to a very minor degree. The need for food cannot be ignored, and the situation may demand that you eat partially cooked or even uncooked food. The flesh of many animals and certain plants grown in the orient contains microscopic parasites. Cook food whenever possible to reduce the risk of becoming infected.

d. Assuming that there will have to be a way to prepare food under hostile conditions, you should be aware of some of the ways in order to achieve some degree of safety and, at the same time, improve palatability. If cooking is considered necessary, use extreme care in selecting the site for a fire and ensure that security considerations are favorable. Prepare the food in very small quantities in order to keep the size of the fire as small as possible. The Dakota Hole configuration (Figure 63) is more appropriate for cooking food during a tactical situation.

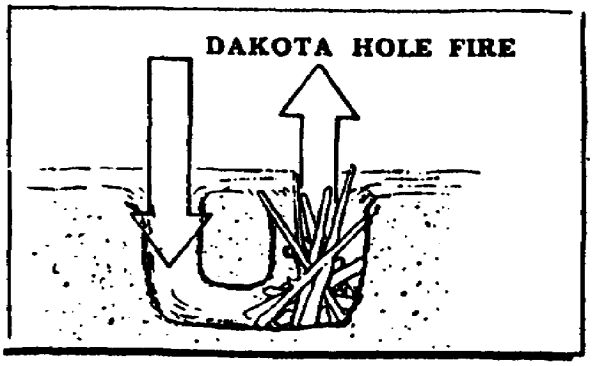


Figure 63. Dakota hole fire lay.

e. You must know how to use the meat of game and fish to your advantage and how to do this with the least effort and physical exertion. Many people have died from starvation because they failed to take full advantage of a game carcass. They abandoned the carcass on the mistaken theory that they could get more game when needed. When preparing meat under survival conditions, save all edible fat. This is especially important in cold climates, as the diet may consist almost entirely of lean meat. You must eat fat in order to provide a complete diet. Rabbits lack fat. The fact that you will die after an extended diet consisting only of rabbit meat indicates the importance of fat in a primitive diet. The same is true of birds such as the ptarmigan.

f. If the animal is large, your first impulse is usually to pack the meat to camp. A procedure often advocated for transporting the kill is to use the skin as a sled for dragging the meat. When the entire animal is dragged, this method may prove satisfactory only on frozen lakes or rivers or over very smooth snow-covered terrain. In rough or brush-covered country, however, it is generally more difficult to use this method, although it will work. Large mountain animals can sometimes be dragged down a snow-filled gully to the base of the mountain. If meat is the only consideration and you do not care about the condition of the skin, you can sometimes roll mountain game for long distances. Before transporting a whole animal, gut it and close the incision. Once the bottom of the hill is reached, almost invariably the method is to backpack the meat to camp, making several trips if no other survivors are present. In some cases, it might be easier and more energy efficient to move the camp to the meat. Under survival conditions, home is on the back. When the weight of the meat proves excessive and moving the camp is not practical, you could eat some of the meat at the scene. Eat the heart, liver, and kidneys as soon as possible to avoid spoilage. Under survival conditions, carefully skin and butcher to save all edible meat. When the decision is made to discard the skin, you can do a rough job; however, consider possible uses for the skin. A square of fresh skin, long enough to reach from the head to the knees, does not weigh much less when it is dried and is an excellent ground cloth under a sleeping bag on frozen ground or snow.

(1) Large game. The best time to skin and butcher an animal is immediately after the kill. However, if an animal is killed late in the day, gut it immediately and accomplish the other work the next morning. Make an effort to keep the carcass secure from predators. Use the big game method when skinning and butchering large game.

(a) The first step in skinning is to turn the animal on its back. With a sharp knife, cut through the skin on a straight line from the tail bone to a point under its neck as illustrated in Figure 64). In making this cut, pass around the anus and, with great care, press the skin open until the first two fingers can be inserted between the skin and the thin membrane enclosing the entrails. When the fingers can be forced forward, place the blade of the knife between the fingers, blade up, with the knife held firmly. While forcing the fingers forward, palm upward, follow with the knife blade, cutting the skin but not the membrane. If the

animal is a male, cut the skin parallel to, but not touching the penis. If the tube leading from the bladder is accidentally cut, a messy job and unclean meat result. If the gall or urine bladders are broken, washing helps clean the meat. Otherwise, it is best not to wash the meat but allow it to form a protective glaze.

(b) On reaching the ribs, it is no longer possible to force the fingers forward because the skin adheres more strongly to flesh and bone. Furthermore, care is no longer necessary. You can quickly complete the cut to point C in Figure 64 by alternately forcing the knife under the skin and lifting it. When the central cut is complete, make side cuts consisting of incisions through the skin, running from the central cut (A-C) up the inside of each leg to the knee and hock joints. Then make cuts around the front legs just above the knees and around the hind legs above the hocks. Make the final cross cut at point C; cut completely around the neck and in back of the ears. Now is the time to begin skinning.

(c) When the animal is large, three people can skin at the same time. However, remember that when it is getting dark and hands are clumsy because of the cold, a sharp skinning knife can make a deep wound. After skinning down the animal's side as far as possible, roll the carcass on its side to skin the back. Then spread out the loose skin to prevent the meat from touching the

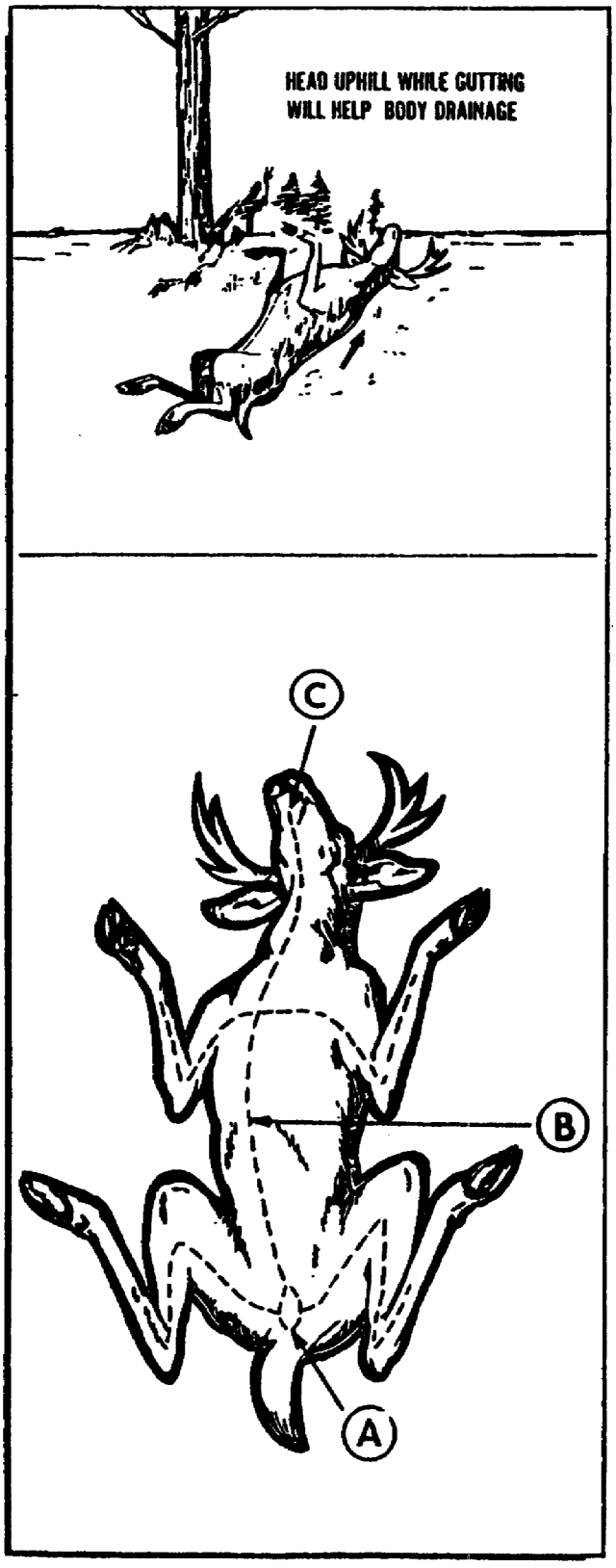


Figure 64. Big game skinning.

ground and turn the animal on the skinned side. Follow the same procedure on the opposite side until the skin is free.

(d) In opening the membrane that encloses the entrails, follow the same procedure used in cutting the skin by using the fingers of one hand as a guard for the knife and separating the intestines from the membrane. Cut away this thin membrane along the ribs and sides in order to see better. Be careful to avoid cutting the intestines or bladder. The large intestine passes through an aperture in the pelvis. This tube must be separated from the bone surrounding it with a knife. Tie a knot in the bladder tube to prevent the escape of urine. With these steps completed, you can easily disengage the entrails from the back and remove them from the carcass. Another method of gutting or field dressing is shown in Figure 65. After gutting is completed, it may be advisable to hang the animal (Figure 66).

NOTE: If it is hot, gut the animal before skinning it.

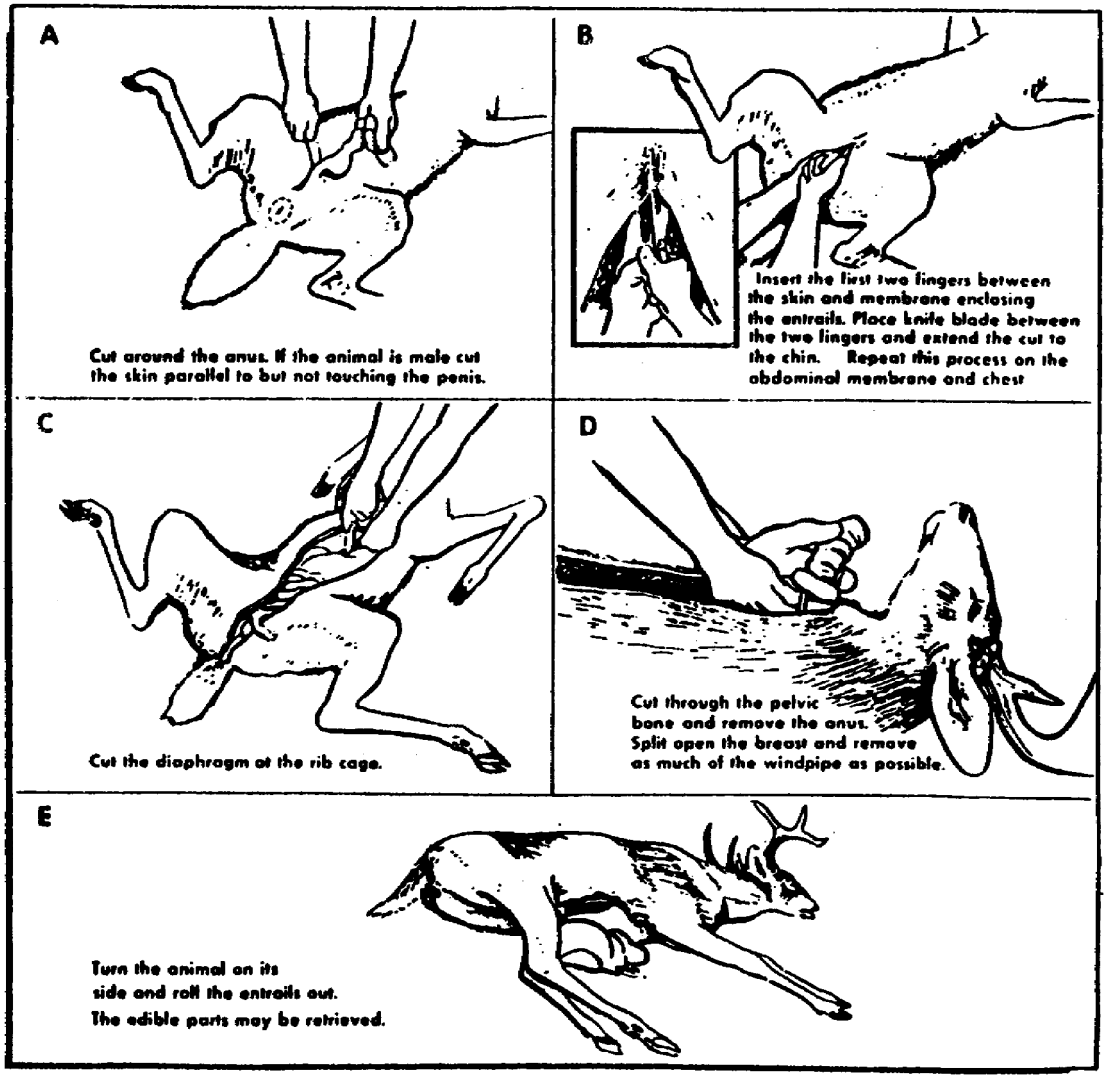


Figure 65. Field dressing.

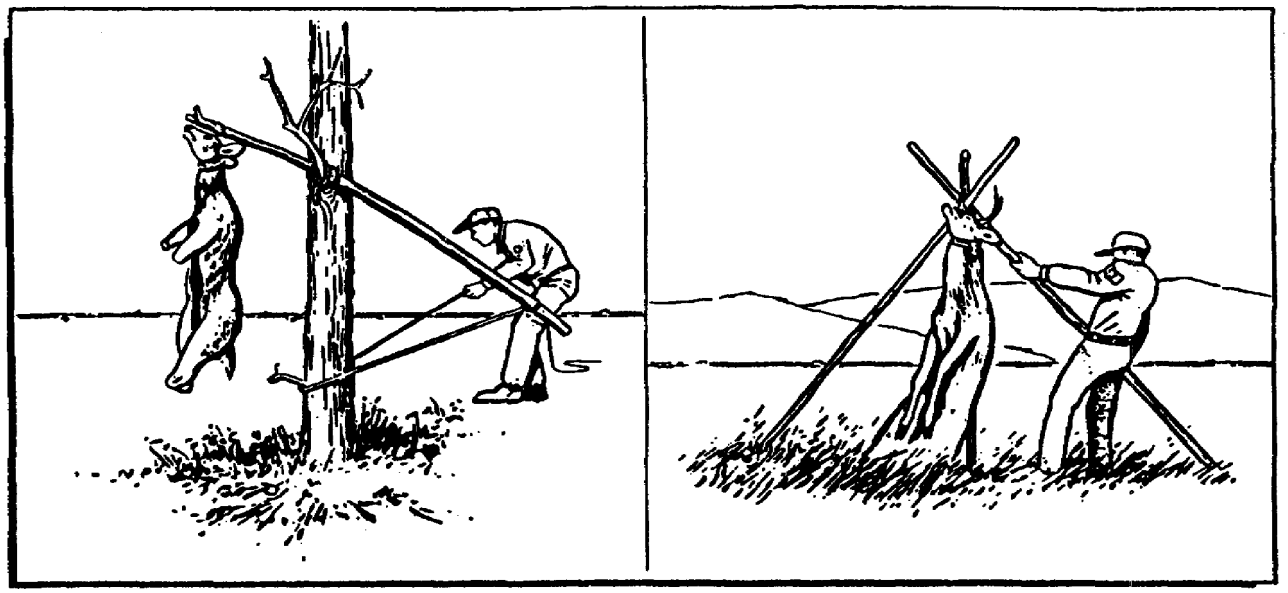


Figure 66. Hanging game.

(e) The intestines of a well-conditioned animal are covered with a lace-like layer of fat that can be lifted off and placed on nearby bushes to dry for later use. Carefully remove the gall bladder (attached to the liver of some animals). If it should happen to rupture, the bile taints anything it touches. Be sure to clean the knife if necessary. The kidneys are imbedded in the back, forward of the pelvis, and are covered with fat. Running forward from the kidneys on each side of the backbone are two long strips of chop-meat or muscle called tenderloin or backstrap. Eat this after the liver, heart, and kidneys as it is usually very tender. Also remove edible meat from the head, ribs, brisket, backbone, and pelvis.

(f) Large animals should be quartered. To do this, cut down between the first and second rib and then sever the backbone with an axe or machete. Cut through the brisket of the front half and then chop lengthwise through the backbone to produce the front quarters. On the rear half, cut through the pelvic bone and lengthwise through the backbone. To make the load lighter and easier to transport, use a knife to bone the animal, thereby eliminating the weight of the bones. Butchering is the final step and is simplified for survival purposes. The main purpose is to cut the meat in manageable size portions (Figure 67).

(2) Small game. You can use the big game method to skin a small or medium-sized animal. One person can skin on each side. The easiest method is to begin at the corners where the cuts meet. However, the glove skinning method is usually performed on small game (Figure 68).

(a) The initial cuts are made down the insides of the back legs. The skin is then peeled back so that the hindquarters are bare and the tail is severed. To remove the remaining skin, pull it down over the body in much the same way a pullover sweater is removed. The head and

front feet are severed to remove the skin from the body. For one-cut skinning of small game, cut across the lower back and insert two fingers under each side of the slit. By pulling quickly in opposite directions, you can easily remove the hide (Figure 69).

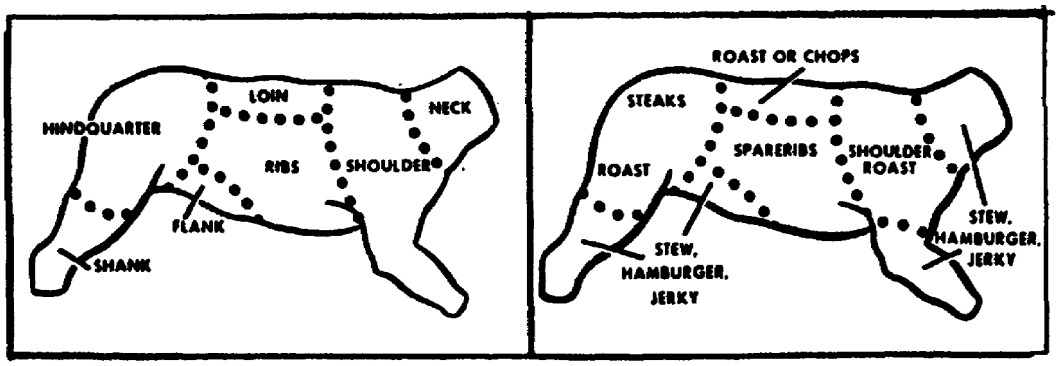


Figure 67. Butchering

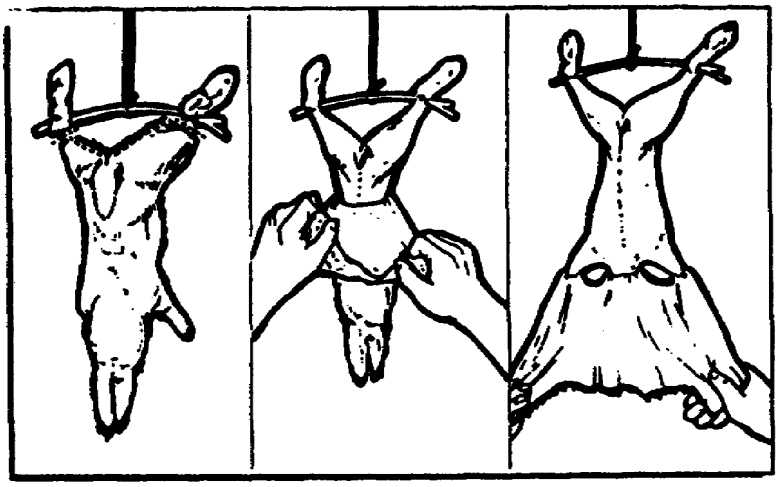


Figure 68. Glove skinning.

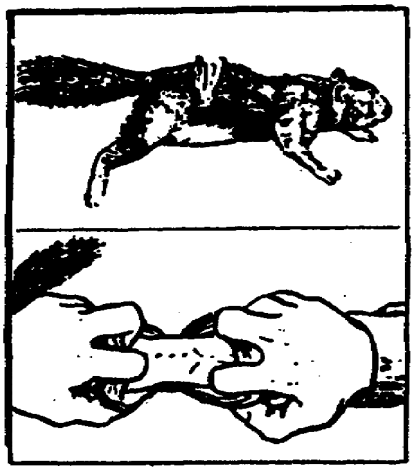


Figure 69. Small animal skinning.

(b) To remove the internal organs, make a cut into the abdominal cavity without puncturing the organs. This cut must run from the anus to the neck. Sever the muscles that connect the internal organs to the trunk to remove the viscera. Gut a rabbit by using a knifeless method with no mess and little time lost. Squeeze the entrails toward the rear; this results in a tight bulging abdomen. Raise the rabbit over the head and sling it down hard, striking the forearms against the thighs. The momentum expels the entrails through a tear in the vent (Figure 70). Save the internal organs (heart, liver, and kidneys) as they are nutritious. Check the liver for any white blotches and discard it if affected. These blotches indicate tularemia (rabbit fever). The disease is transmitted by rodents but also infects humans.

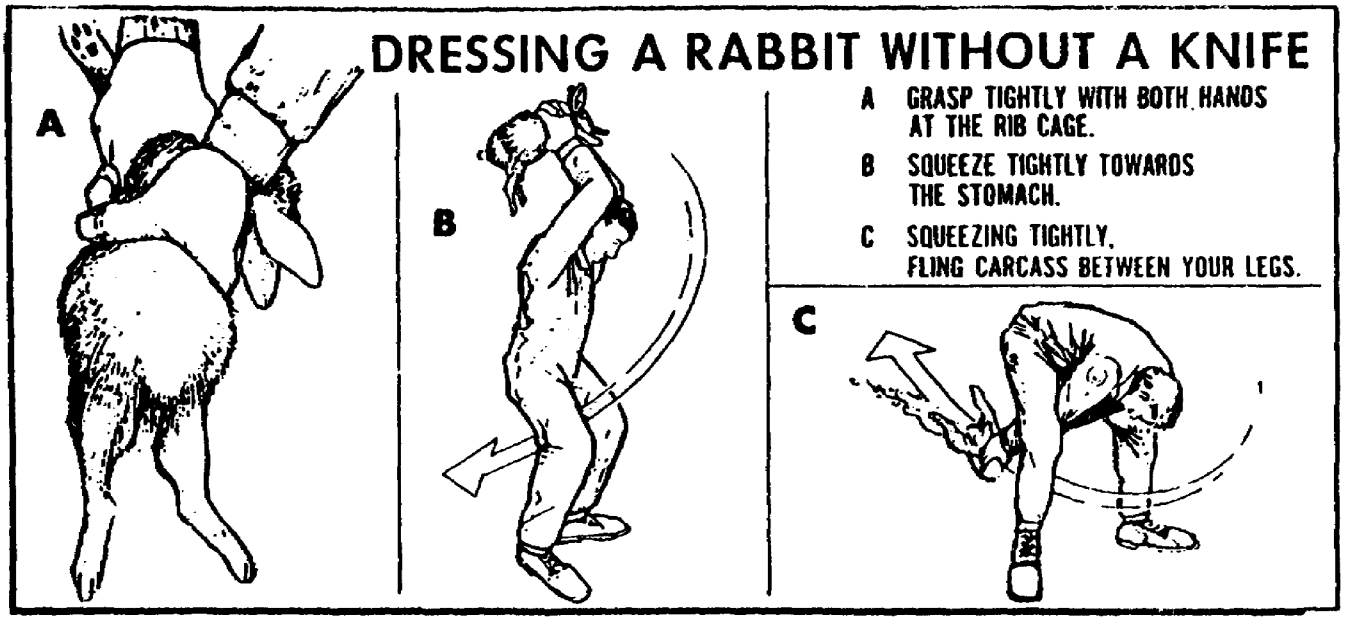


Figure 70. Dressing a rabbit without a knife.

(3) Cold-blooded animals. Cold-blooded animals are generally easy to clean and prepare. Snakes and lizards are very similar in taste and have similar skin. Like the mammals, remove the skin and viscera. The easiest way to do this is to severe the head, legs, or both (Figure 71). In the case of a lizard, peel back enough skin so that you can grasp it securely and simply pull it down the length of the body, turning the skin inside out as it goes. If the skin does not come away easily, make a cut down the length of the animal. This allows the skin to part from the body more easily. Then remove the entrails and cook the animal. Except for the larger amphibians, such as the bullfrog, the hind legs are the largest portion of the animal worth saving. To remove the hindquarters, simply cut through the backbone with a knife leaving the abdomen and upper body. Pull the skin from the legs and cook them. With bullfrogs and larger amphibians, you can eat the whole body. Remove the head, skin, and viscera and either discard them or use them as bait to catch something else.

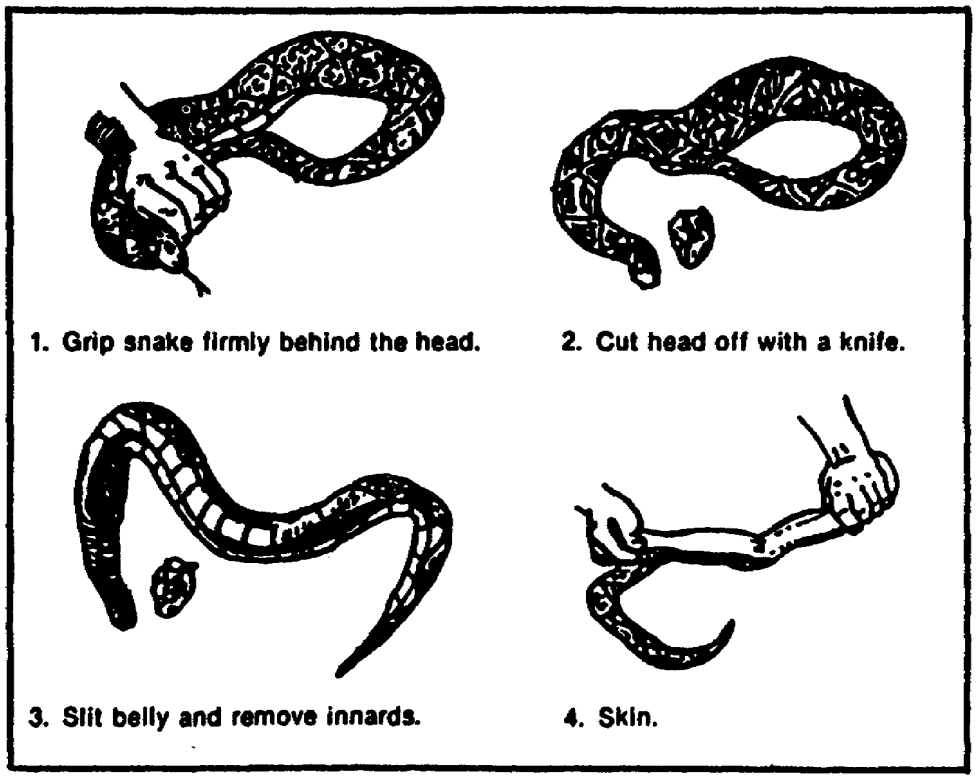


Figure 71. Cleaning a snake.

(4) Birds. Handle birds in the same manner as other animals. Clean them after killing and protect them from flies. All birds have feathers that can be removed in two ways: by plucking or pulling out the feathers and by skinning. The exception is sea birds. Pluck them and cook with the skin on. Boil carrion-eating birds (vultures) for at least 20 minutes to kill parasites before further cooking and eating. Fish-eating birds have a strong, fish-oil flavor. This may be lessened by baking them in mud or by skinning them before cooking. Retain the gizzard, heart, and liver. Split open the gizzard as it contains partially digested food and stones that must be discarded before being eaten.

(5) Fish. Clean all sea life, cut it up, and eat it as soon as possible to avoid spoilage. Most fish need little preparation before they are eaten. Scaling the fish before cooking is not necessary. A cut from the anus to the gills exposes the internal organs for removal. Use the internal parts as bait. Also remove the gills before cooking. The black line along the inside of the backbone is the kidney; remove it by running a thumbnail from the tail to the head. There is some meat on the head so do not discard it. Any meat left over can be preserved by sundrying or smoking. Figure 72 shows one method of filleting a fish.

(6) Insects. Insects are an excellent food source and require little or no preparation. The main point to remember is to remove all hard portions such as the hind legs of a grasshopper and the hard wing covers of beetles. The rest is edible.

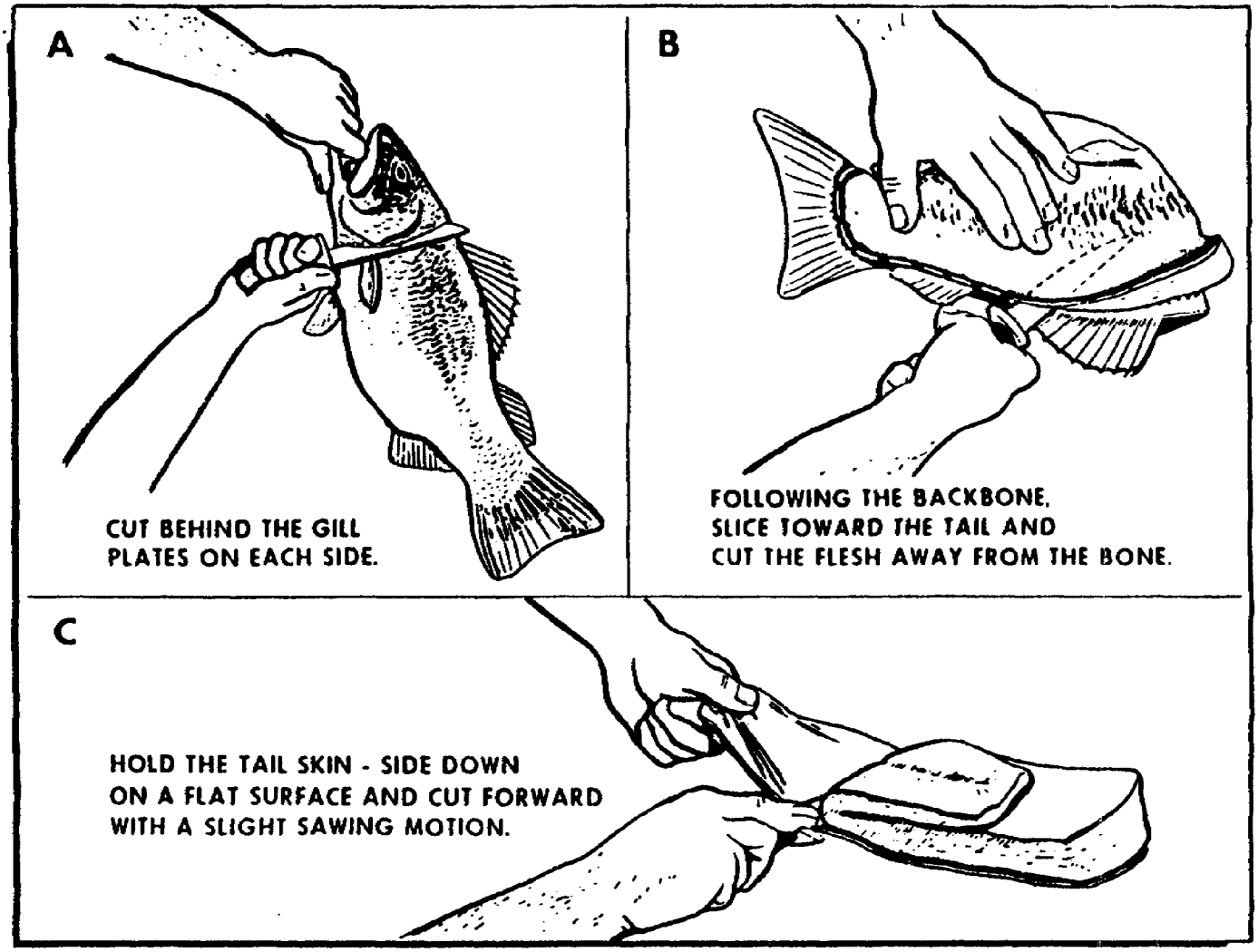


Figure 72. Filleting a fish.

(7) Plants. Preparing plant foods is more involved than preparing animal life. Some plant foods (acorns and tree bark) are bitter because of tannin. These plants require leaching. Leaching involves crushing the plant material, placing it in a container, and pouring large quantities of cold water over it (rinsing the plant parts). This helps wash out the tannin and makes the plant more palatable. Other plants, such as cassave and green papaya, must be cooked before eating to break down the harmful enzymes and chemical crystals within them. This process makes them safe to eat. The manioc (cassava) is best cooked, because the bitter form (green stem) is poisonous when eaten raw. Plants, such as skunk cabbage, must undergo this cooking process several times before they are safe to eat.

(a) Cook all starchy foods since raw starch is difficult to digest. You can boil, steam, roast, or fry them. Some are eaten plain or mixed with other wild foods. Remove starch from sago palm, cycads, and other starch-producing trunks by splitting the trunk and pounding the soft, whitish inner parts with a pointed club. Wash this pulp with water, and drain the white sago (pure starch) into a container. Wash it a second

time and then use it as a flour. One trunk of the sago palm supplies your starch needs for many weeks.

(b) The fiddleheads of all ferns are the curled, young, succulent fronds that have the same food value as cabbage or asparagus. Practically all types of fiddleheads are covered with hair which makes them bitter. Remove the hair by washing the fiddleheads in water. If fiddleheads are especially bitter, boil them for 10 minutes and then re-boil in fresh water for 30 to 40 minutes. Cook wild bird eggs or meat with the fiddleheads to form a stew.

(c) No known grass is poisonous. Gather grass seeds by placing a cloth on the ground and beating the grass heads with sticks. Separate wild grass chaff from the seeds by rubbing them. Then eat them boiled or roasted. If the kernels are still soft and do not have large stiff barbs attached, use them for porridge. If brown or black rust is present, do NOT eat the seeds (ergot poisoning).

(d) Plants that grow in wet places along margins of rivers, lakes, and ponds and those growing directly in water are potential survival food. The succulent underground parts and stems are most frequently eaten. In the tropics, the various members of the calla lily family often grow in very wet places. The leaves of the calla lily look like arrowheads. Jack-in-the-pulpit, calla lily, and sweet flag are members of the Arum family. Cook the members of this plant family in frequent changes of water to destroy the irritant crystals in the stems before eating. Two kinds of marsh and water plants are the cattail and the water lily. The young cattail shoots taste like asparagus. Boil the spikes or steam them when green before eating. The rootstalks, without the outer covering, are eaten boiled or raw. Cut cattail roots into thin strips, dry them, and then grind into flour. They are 46 percent starch, 11 percent sugar, and 43 percent fiber. While the plant is in flower, you can mix the abundant yellow pollen with water and make small cakes or steam it as a substitute for bread. The water lily is considered an important food source by native peoples in many parts of the world. Rootstalks or tubers of water lilies are starchy and high in food value. These plants may be difficult to obtain because of deep water. They can be eaten raw or boiled. Stems may be cooked in a stew; young seed pods may be sliced and eaten as a vegetable. Seeds may be bitter but are very nourishing. They may be parched, rubbed between stones, and used as flour.

(e) Nuts are very high in nutritional value and usually can be eaten raw. Roast nuts near a fire or shake them in a container with hot coals to make them more palatable. You can also grind them to make a flour. If you do not wish to eat a plant or plant part raw, cook it using the same methods used in cooking meat--by boiling, roasting, baking, broiling, or frying.

g. Cooking makes food safer, more digestible, and palatable. Also, the time spent cooking provides a good rest period. On the other hand, some food (sapodilla, star apple, and soursop) is not palatable unless

eaten raw. Cook thoroughly all clams, snails, mussels, crawfish, wild game, large insects (grasshoppers), and freshwater fish to kill internal parasites. You may have to mince mussels and large snails to make them tender.

(1) Boiling.

(a) Boiling is the most nutritious, simplest, and safest method of cooking. If cooking facilities are not available, you will not be able to boil the plant before eating it. In this case, prepare plant food by leaching. If leaching is not possible, follow what steps you can in the edibility test (Figure 26).

(b) Numerous containers can be used for boiling (Figure 73); for instance, a metal container suspended above or set beside a heat source. Green bamboo makes an excellent cooking container. Stone boiling uses super-heated rocks and a container that holds water but cannot be suspended over an open flame. Such containers include survival kit containers, flight helmets, a hole in the ground lined with waterproof material, or a hollow log. Fill the container with food and water and then heat with super-hot stones until the water boils. Cover the container and add new stones as the water stops boiling. If a wire is secured to the rocks before they are put into the container, the rocks can be removed easily. Otherwise, use two sticks in a chopstick fashion.

CAUTION: Do NOT use stones from a stream or damp area because of the moisture in the stones. This moisture may turn to steam and cause the stone to explode while they are being heated in the fire.

(2) Baking. Baking is a very good method of cooking and is usually done by putting food into a container and cooking it slowly. Baking is often used with various types of ovens.

(a) One oven type is wrapping in wet leaves and placing it inside a metal container. Be sure to avoid using a plant that gives an unpleasant flavor to what is being cooked. Food may be packed with mud or clay and placed directly on the coals. Fish and birds packed in mud and baked must not be skinned because the scales, skin, or feathers come off the animal when the mud or clay is removed. Clambake-style baking is done by heating a number of stones in a fire and allowing the fire to burn down to coals. A layer of wet seaweed or leaves is then placed over the hot rocks. Food, such as mussels and clams in their shells, is then placed on the wet seaweed or leaves. More wet seaweed or leaves and soil is used as a cover. Clam, oyster, and mussel shells open when thoroughly steamed in their own juices and may be eaten without further preparation.

(b) You can cook any type of food in the ground in a rock oven. First, dig a hole about 2 feet deep and 2 or 3 feet square, depending on the amount of food to be cooked. Then line the sides and bottom with rock. Next, procure several green trees about 6 inches in diameter and long enough to bridge the hole. Gather firewood and grass or leaves

for insulation. Start a fire in the hole and place two or three green trees over the hole and several rocks on the trees. Maintain the fire until the green trees burn through. This indicates the fire has burned long enough to thoroughly heat the rocks and the oven is ready. Remove the fallen rocks, fire, and ash from the hole and spread a thin layer of dirt over the bottom. Place the insulating material (grass, leaves, or moss) over the soil, then the food, more insulating material on top and around the food, and another thin layer of soil. Place the extra hot rocks on top, and fill the hole with soil up to ground level. Small pieces of meat (steaks and chops) cook in one and one half to two hours. Large pieces take five to six hours.

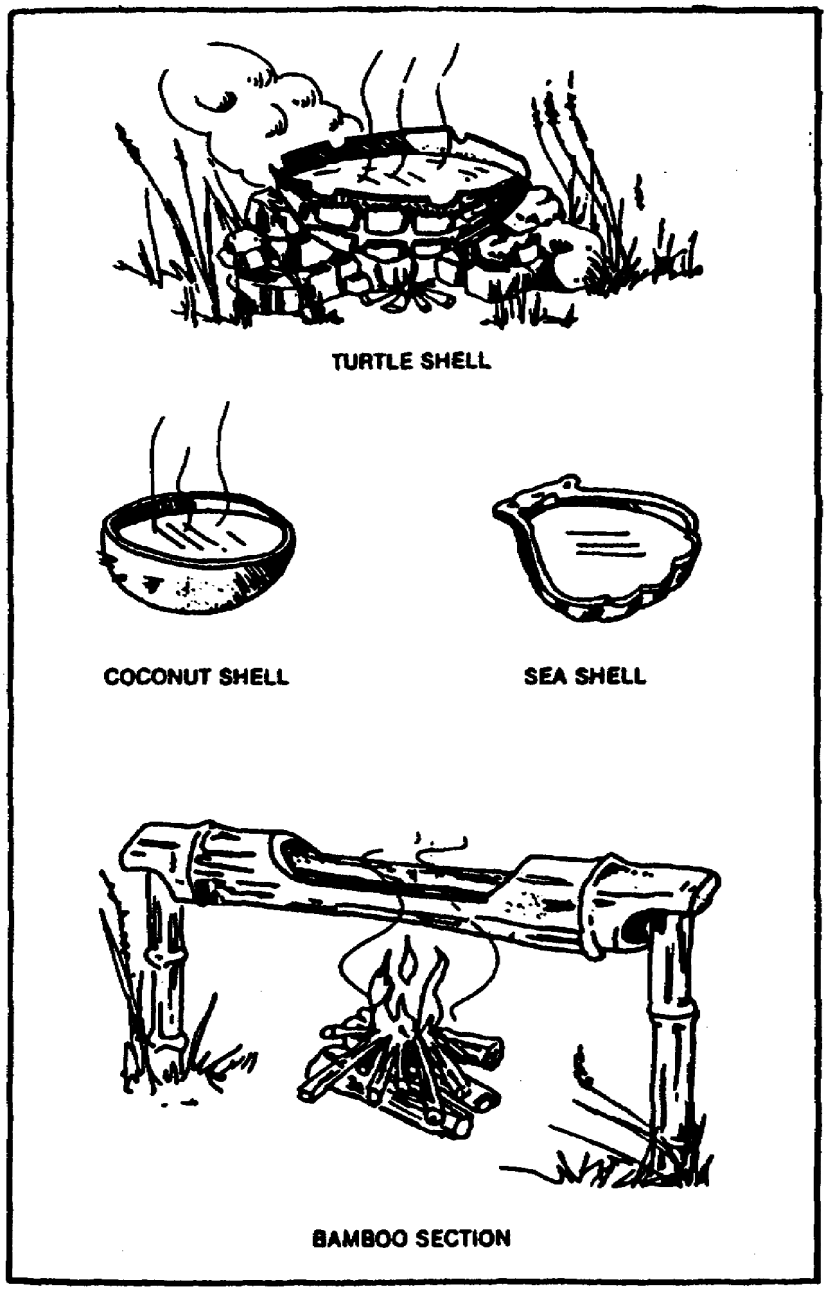


Figure 73. Field-expedient cooking containers.

(3) Roasting. Putting a piece of meat on a stick and holding it over the fire is considered roasting. Roasting is less desirable as it involves exposing the food to direct heat which quickly destroys the nutritional properties.

(4) Broiling. Broiling is the quickest way to prepare fish. You can make a rock broiler by placing a layer of small stones on top of hot coals and laying the fish on the top. Scaling the fish before cooking is not necessary, and small fish need not be cleaned. Fish have a moist and delicious flavor when cooked in this manner. Crabs and lobsters may also be cooked in this manner. An alternate broiling technique is to lay meat on a flat board or stone (planking) and prop it up close to the fire. Turn the meat over at least once to allow thorough cooking. The cooking time depends on how close the meat is to the fire.

(5) Frying. Frying is by far the least favorable method of preparing food. It tends to make the meat tough because most all of the natural juices are cooked out of the meat. Some of the nutritional value of the meat is also destroyed. You can fry on any nonporous surface that can be heated. Such surfaces include unpainted aircraft parts, turtle shells, large seashells, flat rocks, and some survival kit parts.

13. PRESERVATION

Finding natural foods is an uncertain aspect of survival. You must not only make the best use of the available food but also protect it.

a. In survival environments, many animals and insects will devour your food if it is not correctly stored. Protect your food from insects and birds by wrapping it in parachute material, wrapping and tying brush around the bundle, and finally wrapping it with another layer of material. This creates "dead air" space making it more difficult for insects and birds to get to the food. If the outer layer is wetted, evaporation cools the food to some degree. In most cases, if the food is stored several feet off the ground, it is out of reach of most animals. This is done by hanging the food or putting it into a cache. If the food is dehydrated, ensure the container is completely waterproof to prevent reabsorption. Frozen food remains frozen only if the outside temperature remains below freezing. Burying food is a good way to store as long as scavengers are not in the area to uncover it. Consider invasion by insects and small animals when burying the food. Never store food in the shelter as it may attract wild animals.

b. Food, especially meat, has a tendency to spoil within a short period of time unless it is preserved. Some of the most common ways to preserve food are cooking, refrigerating, freezing, and dehydrating.

(1) Cooking. Cooking slows down the decomposition of food but does not eliminate it. This is because many bacteria are present to break it down. Cooking methods, such as boiling, are the least effective for preserving food. Recook food every day until all is consumed.

(2) Refrigeration. Cooling is an effective method of storing food for short periods of time. Heat tends to accelerate the decomposition process where cooling retards decomposition. Freezing eliminates decomposition. Cooling devices available to a survivor include the following:

(a) Earth below the surface, particularly in shady areas or along streams, remains cooler than at the surface. You can dig a hole, line it with grass, and cover it to form an effective cool storage area much the same as a root celler. Food items buried in snow maintain a temperature of approximately 32°F.

(b) Food wrapped in waterproof material and placed in streams remains cool in summer months. Take care to ensure that the food is secured.

(c) You can wrap articles of food in an absorbent material (cotton or burlap) and rewet it as the water evaporates. When water evaporates, it tends to cool down the surrounding area.

(3) Freezing. Once food is frozen, it does not decompose. Therefore, freeze food in meal-sized portions to avoid repetitious thawing and refreezing.

(4) Dehydrating. Drying removes all moisture from the food, thereby significantly retarding the decomposition process. Drying is done by sunning, smoking, or burying it in hot sand.

(a) For sun-drying, slice the food very thin and place it in direct sunlight. Cut meat across the grain to improve tenderness and decrease drying time. If salt is available, add it to improve flavor and accelerate the drying process.

(b) Smoking is a process done through the use of nonresinous wood (willow or aspen). These woods produce smoke that adds flavor and dries the meat. A smoke rack is necessary to contain the smoke (Figure 74). To dry meat using smoke, cut the meat very thin and across the grain. If the meat is warm and difficult to slice thin, cut the meat in 1-or 2-inch cubes and beat it thin with an improvised clean wooden mallet. Remove the fat and hang the meat on a rack so that each piece is separate. Elevate the meat no less than 2 feet above the coals. Then place the coals in the bottom of a smoke rack and add green woodchips on top to produce smoke.

(c) To dry food in hot sand, prepare as for sun drying. Then wrap the food in fabric or natural materials (palm leaves), place it in a pit, and cover it with the sand.

c. The method used to preserve fish through warm weather is similar to that used in preserving meat (Figure 75). When there is no danger of predatory animals disturbing the fish, place the fish on available fabric

and allow it to cool during the night. Early the next morning, before the air gets arm, roll the fish in moist fabric (and leaves). Then place this bundle inside your pack. During rest periods or when the pack is removed, place it in a cool location out of the sun's rays.

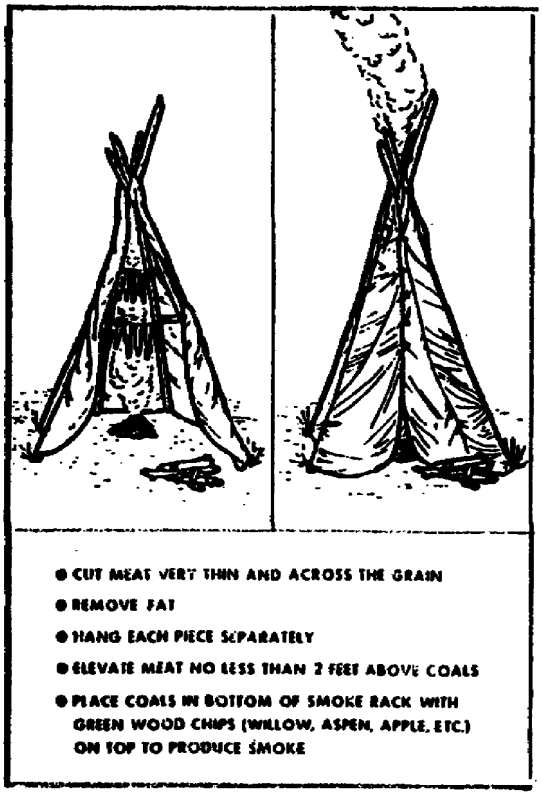


Figure 74. Smoke-drying.

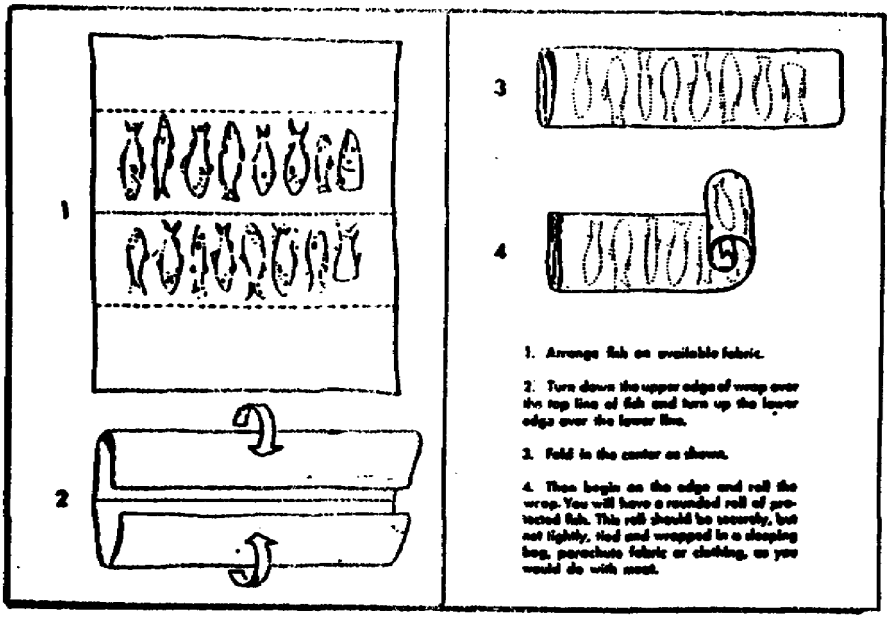


Figure 75. Preserving fish.

(1) Dry fish in the same manner described for smoking meat. Remove the heads and backbone and spread the fish flat on a grill. Use skewers made of thin willow branches with the bark removed and then smoke the fish.

(2) Fish may also be dried in the sun. Suspend them from branches or spread them over hot rocks. When the meat has dried, use sea water or salt on the outside, if available, for further protection.

d. If you have been able to procure more plant foods than you can eat, preserve the excess in the same manner as animal foods. Dry plant foods by wind, air, sun, or fire with or without smoke. You can also use a combination of these methods. The main object is to remove the moisture. Most wild fruits can be dried. If the plant part is large, such as some tubers, slice it and then dry it. Some type of protection may be necessary to prevent consumption or contamination by insects. Carry extra fruits or berries by wrapping them in leaves or moss.

Section II. WATER

14. REQUIREMENTS

Normally, with atmospheric temperature of about 68 degrees Fahrenheit (°F), the average adult requires 2 to 3 quarts of water daily. This water is necessary to replace that lost daily through urine (approximately 1.4 quart), sweat (about 0.1 quart), feces (approximately 0.2 quart), and insensible water loss. When you are unaware water loss is actually occurring, it is referred to as insensible water loss. Insensible water loss occurs by diffusion through the skin and evaporation through the lungs. Water loss through the skin occurs as a result of the actual diffusion of water molecules through the cells of the skin. The average loss of water in this manner is approximately 0.3 to 0.4 quart. Fortunately, the outermost layer of the skin, the epidermis, prevents loss of greater quantities of water by diffusion. The skin acts as a barrier to this type of water loss. Inhaled air initially contains very little water vapor. However, as soon as it enters the respiratory passages, the air is exposed to the fluid covering the respiratory surfaces. By the time this air enters the lungs, it has become totally saturated with moisture from these surfaces when the air is exhaled, it is still saturated with moisture, and water is Lost from the body.

a. Larger quantities of water are required when water loss is increased through—

(1) Heat exposure. When an individual is exposed to very high temperatures, water lost in the sweat is increased to as much as 3.5 quarts an hour. Water loss at this increased rate depletes the body fluids in a short time.

(2) Exercise. An increased respiration rate causes increased water loss by evaporation through the lungs. Increased body heat causes excessive sweating.

(3) Cold exposure. As the temperature decreases, the amount of water vapor in the air also decreases. Therefore, breathing cold air increases water loss by evaporation from the lungs.

(4) High altitude. Increased water evaporation loss through the lungs occurs at high altitudes. Not only does this happen because of breathing cooler air but also because of the required increased respiratory efforts.

(5) Burns. After extensive burns, the outermost layer of the skin is destroyed. When this layer is gone, there is no longer a barrier to water loss by diffusion. The rate of water loss in this manner can increase up to 5 quarts each day.

(6) Illness. Severe vomiting or prolonged diarrhea also leads to serious water depletion.

b. Dehydration (body fluid depletion) occurs when required body fluids are not replaced.

(1) Dehydration is accompanied by thirst, weakness, fatigue, headaches, fever, dizziness, and inelastic abdominal skin. An individual also has dry mucous membranes; that is, dry mouth and nasal passages. Infrequent urination occurs reducing output volume. The urine is so concentrated that it is very dark in color. In severe cases, urination may be quite painful.

(2) Companions will observe behavioral changes in individuals suffering from dehydration. Those changes include apathy, impatience, sleepiness, lagging pace, loss of appetite, indistinct speech, mental confusion, and emotional instability.

(3) Dehydration is a complication that causes decreased efficiency in performing even the simplest task. It also predisposes survivors to develop severe shock following minor injuries. Blood vessels in the skin constrict as a result of dehydration. This increases the danger of cold injury during cold exposure. Failure to replace body fluids ultimately results in death.

c. To prevent dehydration, replace water loss by periodically taking small quantities of water throughout the day. As activities or conditions intensify, increase the water intake accordingly. Water intake should be sufficient to maintain a minimum urinary output of 1 pint every 24 hours. However, thirst is not an adequate stimulus for water intake. A person often dehydrates when water is available. Therefore, encourage water intake when the person is not thirsty. Humans cannot adjust to decreased water intake for prolonged periods of time. When water is in a short

supply, consume any available water sensibly. If sugar is available, mix it with the water. Make an effort to find a local water source. Until a suitable water source is located, limit individual water losses in the following ways:

(1) Limit physical activity to the absolute minimum required for survival activities. Perform all tasks slowly and deliberately with minimal expenditure of energy. Include frequent rest periods in the daily schedule.

(2) In hot climates, conduct essential activity at night or during the cooler part of the day. Wear clothing at all times, because it reduces the quantity of water loss by sweating. Sweat absorbed into the clothing evaporates from its surface in the same manner as it evaporates from the body. This evaporation cools the air trapped between the clothing and the skin. The cooling process decreases the activity of the sweat glands and subsequently reduces water loss. Wear light-colored clothing in hot weather rather than dark-colored clothing. Dark-colored clothing absorbs the sun's light rays and converts them into heat. This heat causes an increase in body temperature which, in turn, activates the sweat glands and increases water loss through sweating. Light-colored clothing, however, reflects the sun's light rays and minimizes the increase in body temperature and subsequent water loss.

d. To treat dehydration you must replace lost body fluids. The most readily available means of correcting this deficiency is to drink water. A severely dehydrated person has little appetite. You must encourage this person to drink small quantities of water at frequent intervals to replenish his body's fluid volume. Warm cold water so that his system will accept it easier.

15. SOURCES

The initial shock of the survival experience sometimes produces feelings of thirst; therefore, be aware of the water sources available and the resources at your disposal for producing water. Aircrew members would be wise to carry water during their missions. Having an additional water container is a great benefit.

a. Keep issued items (canned water, desalter kits, and solar stills) for times when no natural sources of freshwater are available. One day you may have to use these items and methods of procuring water. Therefore, know the operating instructions and the amount of water they produce.

(1) Canned water provides 10 ounces per can.

(2) Desalter kits are limited to 1 pint per chemical bar. Each kit contains eight chemical bars.

(3) A sea solar still produces as much as 2 1/2 pints per day. Land solar stills produce varied amounts of water. The amount is directly proportionate to the amount of water available in the soil or placed into the still (vegetation, entrails, or contaminated water) and the ambient temperature.

b. Several indicators of possible water are drainages, large clumps of plush grass, and low-lying areas. The presence of abundant vegetation of a different variety, such as deciduous growth in a coniferous area, is an indicator of possible water. Also, animal trails may lead to water. The "V" formed by intersecting trails often points toward a water source.

c. Naturally occurring indicators of water include surface water (streams, lakes, springs, ice, and snow); precipitation (rain, snow, dew, and sleet); and subsurface water. Because wells, cisterns, and underground springs and streams may not be as readily accessible, subsurface water can be difficult for you to locate and use.

(1) Surface water.

(a) The presence of swarming insects indicates water is near. In some places, look for signs of animal presence. In damp places, animals may have scratched depressions into the ground to obtain water; insects may also hover over these areas.

(b) In the Libyan Sahara, donut-shaped mounds of camel dung often surround wells or other water sources. Bird flights can indicate direction to or from water. Pigeons and doves make their way to water regularly. They fly from water in the morning and to it in the evening. Also, large flocks of birds may congregate at or around water areas.

(c) The presence of people indicates water. The location of this water can take many forms--wells, pools, irrigation systems, and stored water in containers that are carried by people who are traveling. Evaders need to be extremely cautious when approaching any water source, especially if they are in dry areas; these places may be guarded or inhabited.

(2) Precipitation. You may procure precipitation by laying a piece of nonporous material (a poncho, piece of canvas, plastic, or metal) on the ground. Consider the possibility of contaminating the water with dyes, oils, or preservatives on the surfaces of the objects used to collect the precipitation. If you are collecting rain or snow, it may be more efficient to create a bag or funnel shape with the material so the water can be easily gathered. Collect dew by wiping it up with a sponge or cloth first and then wringing it into a container (Figure 76). Ice yields more water per given volume than snow and requires less heat to do so. If the sun is shining, place snow or ice on a dark surface to melt (dark surfaces absorb heat; whereas, light surfaces reflect heat). Ice is found in the form of icicles on plants and trees, sea ice, or sheet ice on rivers, ponds, and lakes. If snow must be used, use the snow closest to the ground. This snow is packed and provides more water for the amount of snow than do the

upper layers. When snow is melted for water, place a small amount of snow in the bottom of a container and place it over or near a fire. Then add snow a little at a time as it melts. Allow water in the container bottom to become warm so that when more snow is added, the mixture remains slushy and prevents burning the container bottom. Snow absorbs water; if packed, it forms an insulating airspace at the bottom of the container. When this happens, the bottom may burn out.

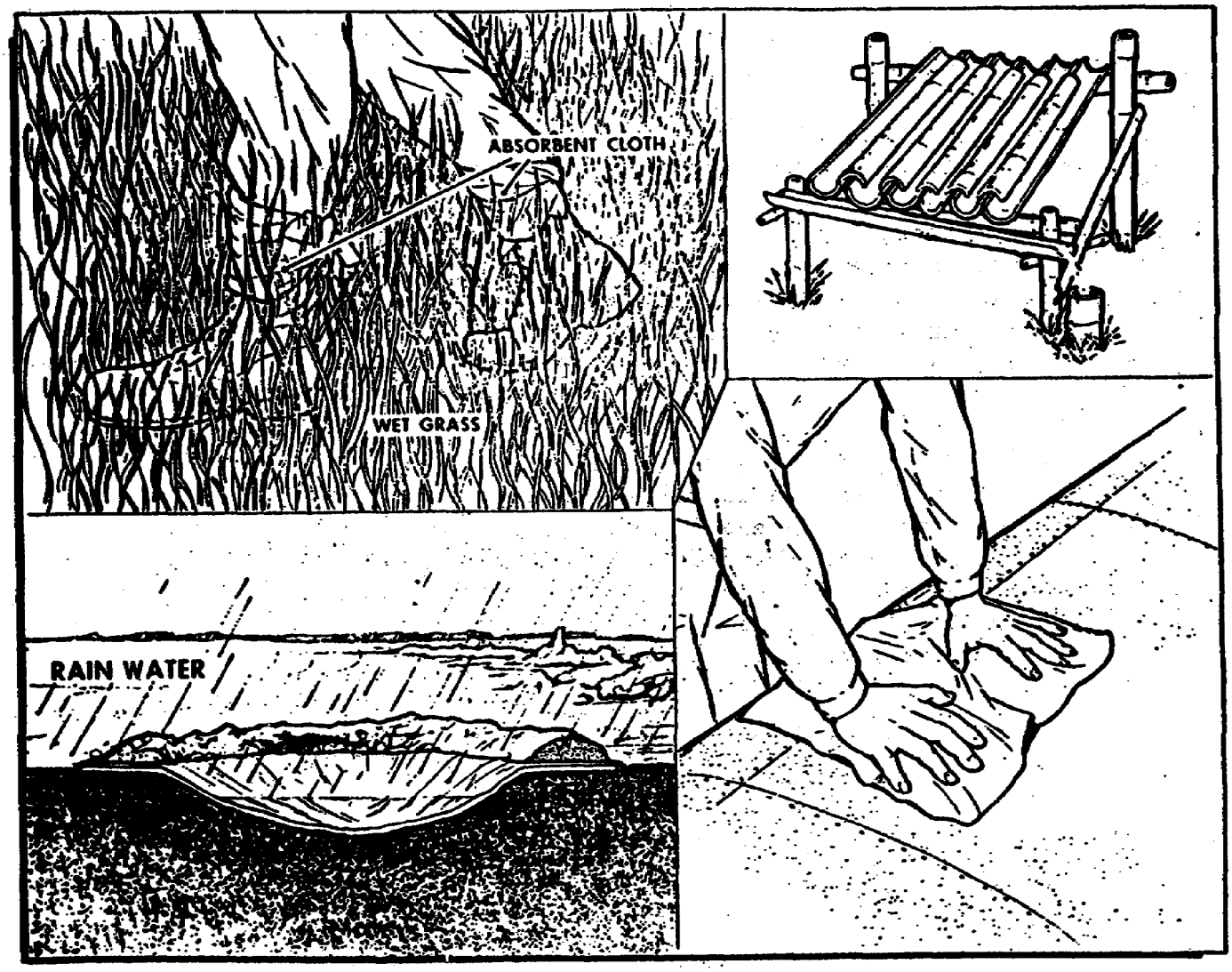


Figure 76. Methods of procuring water.

(3) Subsurface water. When no surface water is available, you may have to tap the earth's supply of ground water. Access to this depends on the type of ground--clay, sand, rock, gravel, or other loose material.

(a) In rocky ground, look for springs and seepages. Limestone and lava rocks have more and larger springs than any other rocks. Most lava rocks contain millions of bubble holes; ground water may seep through them. You can also look for springs along the walls of valleys that cross a lava flow. Some flows have no bubbles but do have "organ

pipe" joints--vertical cracks that part the rocks into columns a foot or more thick and 20 feet or more high. At the foot of these joints, you may find water creeping out as seepage or pouring out in springs.

(b) Most common rocks, like granite, contain water only in irregular cracks. A crack in a rock with bird dung around the outside may indicate a water source that can be reached by a piece of surgical hose (tubing) used as a straw or siphon.

(c) Water is more abundant and easier to find in loose sediments than in rocks. Springs are sometimes found along valley floors or down along their sloping sides. The flat benches or terraces of land above river valleys usually yield springs or seepages along their bases, even when the stream is dry. Don't waste time digging for water unless there are signs that water is available. Digging in the floor of a valley under a steep slope, especially if the bluff is cut in a terrace, can produce a water source. A lush green spot where a spring has been during the wet season is a good place to dig for water. Water moves slowly through clay, but many clays contain strips of sand that may yield springs. Look for a wet place on the surface of clay bluffs and try digging it out.

(d) Along coasts you may find water by digging beach wells (Figure 77). Locate the wells behind the first or second pressure ridge. Dig wells 3 to 5 feet deep and line them with driftwood to prevent sand from refilling the hole. Use rocks to line the bottom of the well to prevent stirring up sand when procuring the water. The average well may take as long as two hours to produce 4 to 5 gallons of water. (Do not be discouraged if the first try is unsuccessful--dig another.)

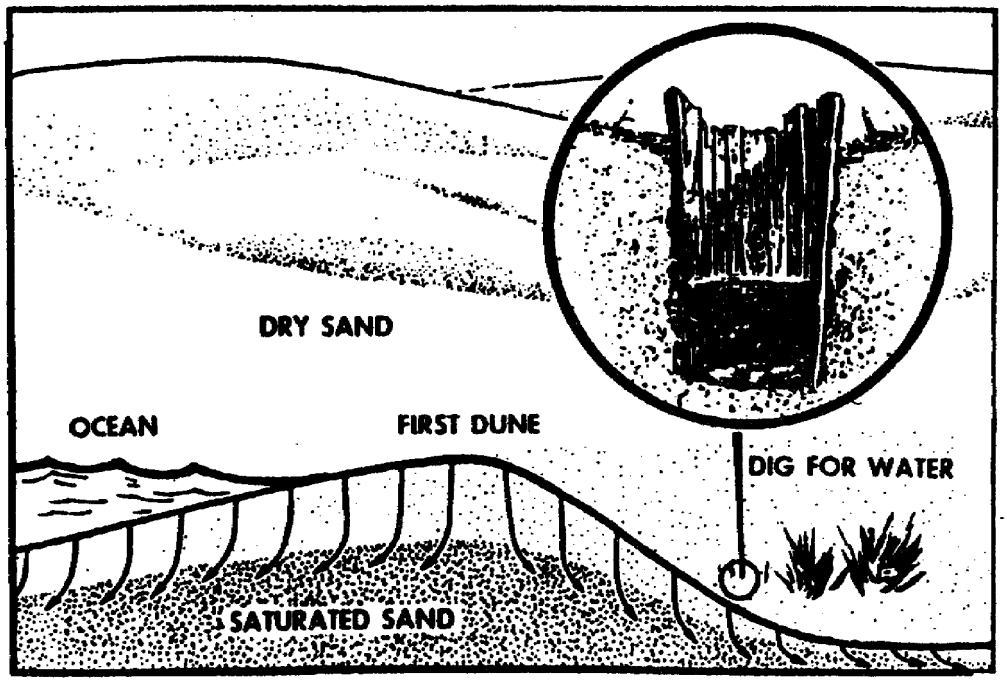


Figure 77. Beach well.

16. PREPARATION

a. You need to determine the presence of harmful agents in the water. Some ways to possibly do this include noticing foam, bubbles, or strong odors in the water or whether the water is turbid (muddy with sediment) or discolored. Water from lakes found in desert areas are sometimes salty because they have been without an outlet for extended periods of time. Magnesium or alkali salts may produce a laxative effect; if not too strong, it is drinkable. If the water gags you or causes gastric disturbances, discontinue drinking. The lack of healthy green plants growing around any water source is a good sign that the water may not be potable.

b. Because of a potential aversion to water from natural sources, render it as potable as possible through filtration. Filtration only removes the solid particles from water-it does not purify it. One simple and quick way of filtering is to dig a sediment hole or seepage basin along a water source and allow the soil to filter the water (Figure 78). Be sure to cover the seepage hole while not in use. Another way is to construct a filter--layers of parachute material stretched across a tripod (Figure 79). Use charcoal to eliminate bad odors and foreign materials from the water and activated charcoal (obtained from freshly burned wood) to filter the water. If a solid container is available for making a filter, use layers of fine-to-coarse sand and gravel with charcoal and grass (Figure 80).

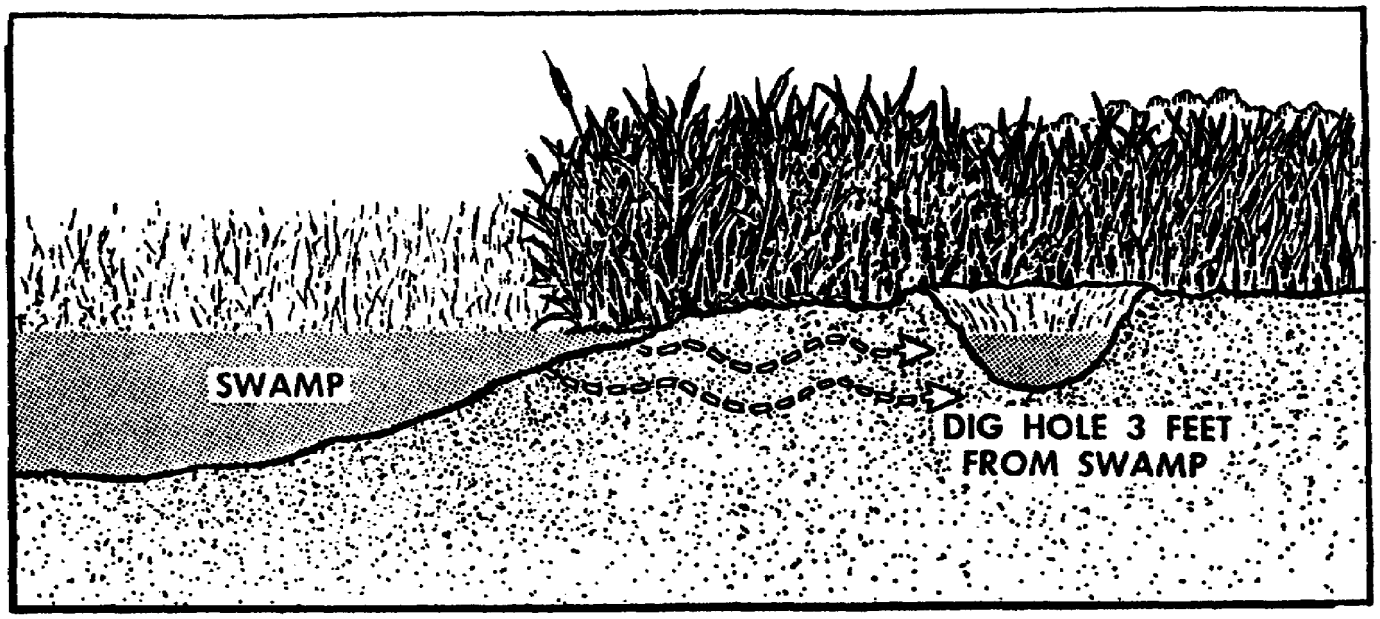


Figure 78. Sediment hole.

c. Water purification may be done in a variety of ways. The situation dictates the method used, such as tactical or nontactical. One way is to boil the water for at least 10 minutes. Another way is to use purification tablets according to the instructions on the bottle--one tablet per quart of clear water; two tablets if the water is cloudy. Let the water

stand for 5 minutes to allow the tablet to dissolve. Then shake and allow it to stand for 15 minutes more. Remember to turn the canteen over and allow a small amount of water to seep out and cover the neck part of the canteen to sterilize it. In an evasion situation, use water purification tables for purifying water. If these are not available, you can consume water from plant sources or nonstagnant, running water obtained from a location upstream from habitation. Also, you can use eight drops of 2 1/2 percent iodine per quart of water. Stir or shake the contents and let it stand for at least 10 minutes.

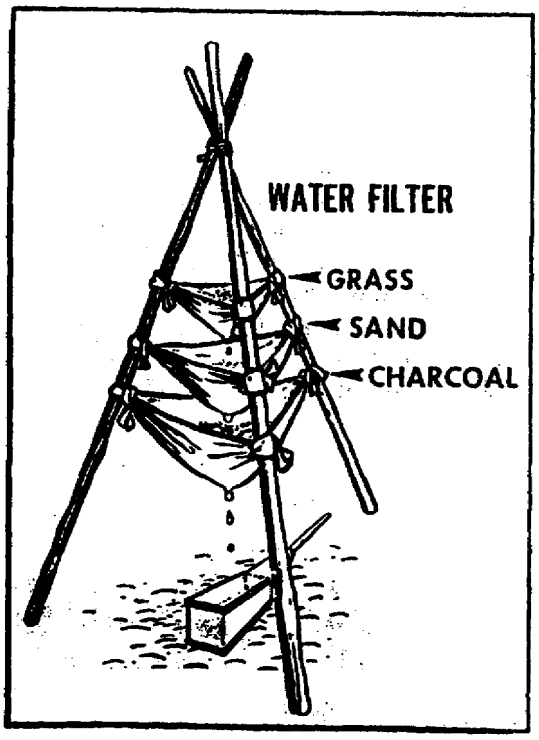


Figure 79. Water filter.

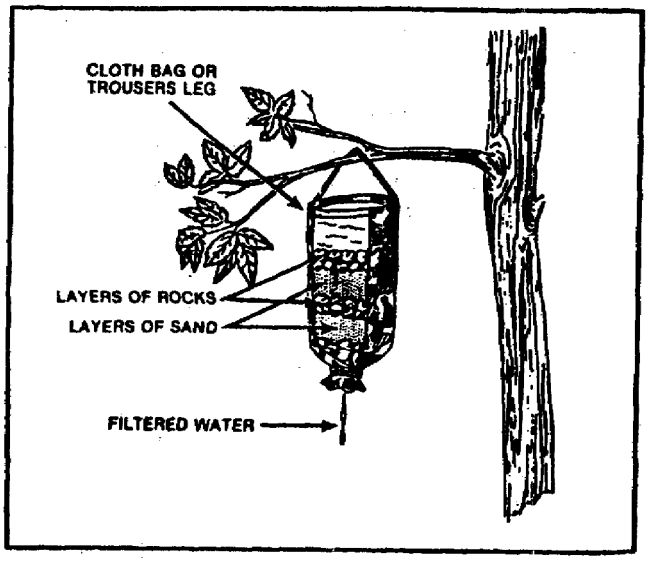


Figure 80. Water filtering system.

d. After water is found and purified, you may wish to store it for later consumption. Good containers include a canteen, a waterbag, a life preserver unit (known as an LPU) bladder, a segment of bamboo, a birch bark and pitch canteen, a hood from an antiexposure suit, and a prophylactic placed inside a sock to protect the bladder.

17. TROPICAL CLIMATES

Depending on the time of the year and type of jungle, water in the tropical climates can be plentiful; however, it is necessary to know where to look and how to procure it. Surface water is normally available in streams, ponds, rivers, and swamps. In the savannas during the dry season, it may be necessary for you to resort to digging for water in these

same places. Water obtained from these sources may need filtration and should be purified. Jungle plants also provide water.

a. Many plants have hollow portions that can collect precipitation, such as rainfall and dew (Figure 81). Since there is no absolute way to tell whether this water is pure, it should be purified. The stems or leaves of some plants have a hollow section where the stem meets the trunk. Look for water collected here. This includes any Y-shaped plants (palms or air plants). The branches of large trees often support air plants (relatives of the pineapple) whose overlapping, thickly growing leaves may hold a considerable amount of rainwater. Trees may also catch and store rainwater in natural receptacles (cracks or hollows).

Figure 81. Water collectors.

b. Pure freshwater needing no purification is obtained from numerous plant sources. Many varieties of vines are potential water sources. The

vines are from 50 feet to several hundred feet in length and 1 to 6 inches in diameter. They grow like a hose along the ground and up into the trees. The leaf structure of the vine is generally high in the trees. Water vines are usually soft and easily cut. Small species may be twisted or bent easily and are usually heavy because of the water content. Test the water from these vines for potability.

(1) The first step in testing the water from vines is to nick the vine and watch for sap running from the cut. If milky sap is seen, discard the vine; if no milky sap is seen, the vine may be a safe water vine. Cut out a section of the vine, hold that piece vertically, and observe the liquid as it flows out. If it is clear and colorless, it may be drinkable; if it is cloudy or milky-colored, discard the vine. Let some of the liquid flow into the palm of your hand and observe it. If the liquid does not change color, you can taste it. If it tastes like water or has a woody or sweet taste, it should be safe for drinking. Avoid liquid with a sour or bitter taste.

(2) Water trapped within a vine is easily obtained by cutting out a section of the vine. First, cut the vine high above the ground and then near the ground. This provides a long length of vine and, in addition, tends to hide evidence of the cuts if you are in an evasion situation. When drinking from the vine, do NOT touch the mouth as the bark may contain irritants that could affect the lips and mouth. (Figure 82, A). The pores in the upper end of the section of vine may reclose, stopping the flow of water. If this occurs, cut off the end of the vine opposite the drinking end to reopen the pores and allow the water to flow.

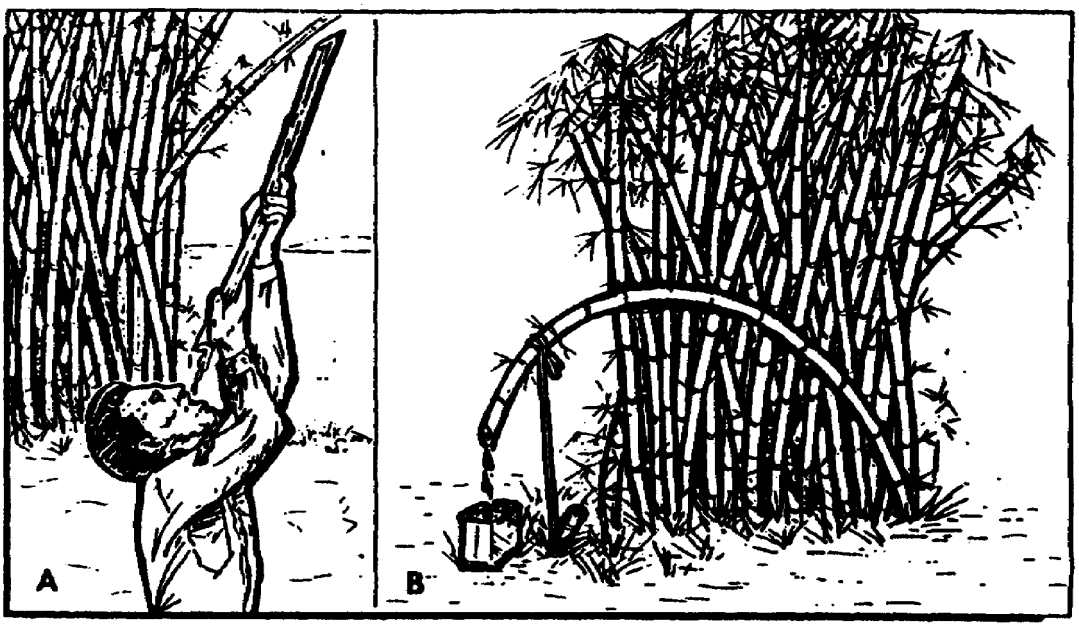


Figure 82. Water vines and bamboo.

c. Obtain water from the rattan palm and spiny bamboo in the same manner as from vines. It is not necessary to test the water if positive

identification of the plant is made. The slender stem (runner) of the rattan palm is an excellent water source. The joints seem to overlap as if one section is fitted inside the next.

d. Water may be trapped within sections of green bamboo. Shake the bamboo to determine if water is trapped within a section. If it contains water, a sloshing sound is heard. Make an opening in the section by making two 45-degree-angle cuts on the same side of the section, then pry loose a piece of the section wall. Cut off the end of the section and drink or pour the water from the open end. Examine the inside of the bamboo before consuming the water. If the inside walls are clean and white, the water is safe to drink. If there are brown or black spots, fungus growth, or any discoloration, purify the water before drinking it. Sometimes water is obtained by cutting the top off certain types of green bamboo, bending it over, and staking it to the ground (Figure 82, B). Place a water container under it to catch the dripping water. This method also proves effective on some vines and the rattan palm.

e. Banana plants are also a water source in a couple of different ways, neither of which is satisfactory in a tactical situation. First, cut a banana plant down, then cut off a long section that can be easily handled. Take this section apart by slitting from one end to the other and pulling off the layers one at a time. Remove from the convex side, a strip 3 inches wide, the length of the section, and just deep enough to expose the cells. Then fold this section toward the convex side to force the water from the cells of the plant. Gently squeeze the layer to avoid forcing out any tannin into the water. Another technique is by making a "banana-well." Make a bowl out of the plant stump that is fairly close to the ground, by cutting out and removing the inner section of the stump (Figure 83). The first water that enters the bowl may contain a concentration of tannin (an astringent which has the same effect as alum). Place a leaf from the banana plant or another plant over the bowl while it is filling to prevent contamination by insects and such.

f. Water trees are also valuable sources of water in some jungles. They are identified by their fairly thin and smooth blotched bark. The leaves are large, fuzzy, leathery, and evergreen. They may grow as large as 8 or 9 inches. The trunks may have short out-growths with fig-like fruit on them or long tendrils with round fruit comprised of corn kernel-shaped nuggets.

(1) In a nontactical situation, the tree can be tapped in the same manner as a rubber tree with either a diagonal or a "V" slash. When the bark is cut into, it exudes a white sap. If ingested, this sap causes temporary irritation of the urinary tract. The sap dries quite rapidly and is easily removed. Continue the cut into the tree and place a spigot at the bottom of the tap to direct the water into a container. Make the spigot from bamboo or a knife. The water flows from the leaves back into the roots after sundown, so water can be procured from this source only after sundown or on overcast (cloudy) days.

(2) If survivors are in a tactical situation, they can obtain water from the tree and still conceal the procurement location. If the long tendrils are growing thickly, they can separate them and bore a hole into the tree. Scrape off the white sap and place a spigot below the tap with a water container to catch the water. Moving the tendrils back into place conceals the container. Instead of boring into the tree, a couple of tendrils can be cut off or snapped off if no knife is available. Allow the white sap to dry and then remove it. Place the ends of the tendrils in a water container and then conceal the container.

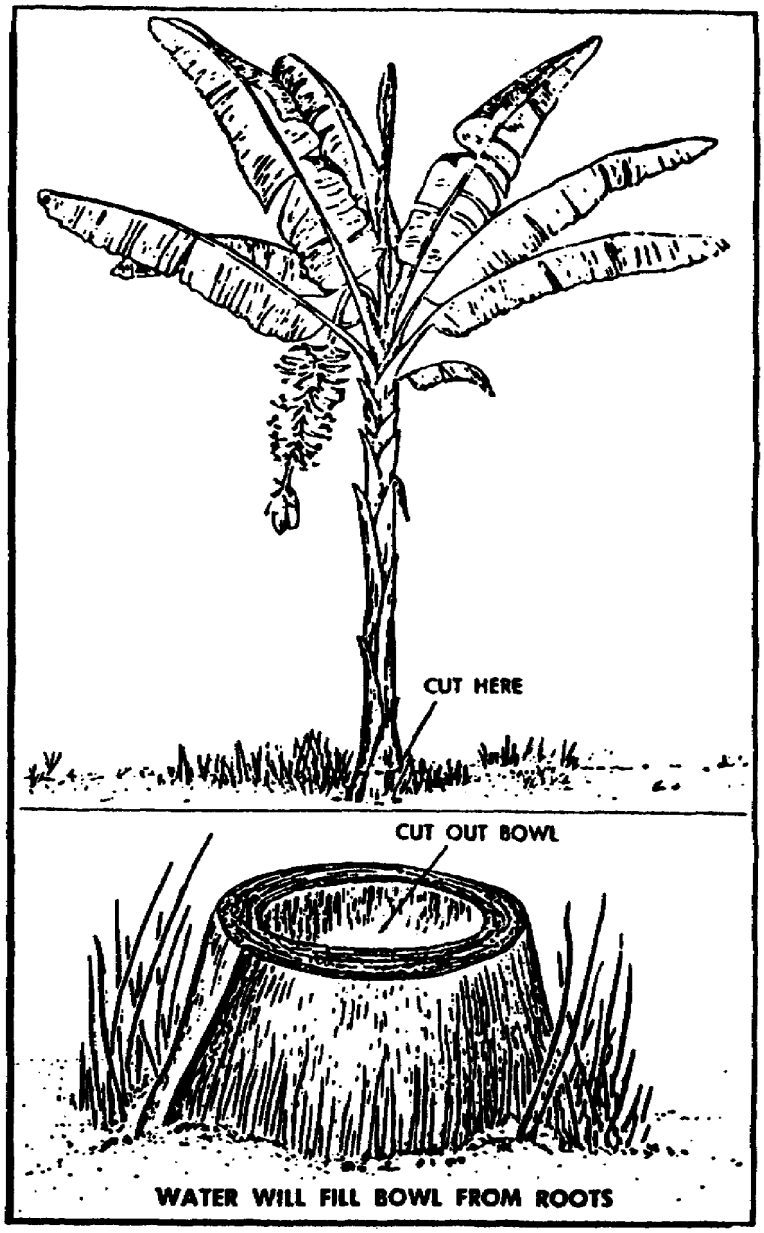


Figure 83. Water from banana plant.

g. Coconuts are used as a water source if they are available. The liquid inside is refreshing. In a mature coconut this fluid contains oil

which, when consumed in excess, causes diarrhea. There is little problem if it is used in moderation or with a meal and not on an empty stomach. Green unripe coconuts about the size of a grapefruit are the best, because the fluid can be taken in large quantities without harmful effects. There is more fluid and less oil in this size, so there is less possibility of diarrhea.

h. You can also obtain water from liquid mud. Filter mud through a piece of cloth. Water by this method must be purified. Rainwater Can be collected from a tree by wrapping a cloth around one that is slanted and arranging the bottom end of the cloth to drip into a container (Figure 84).

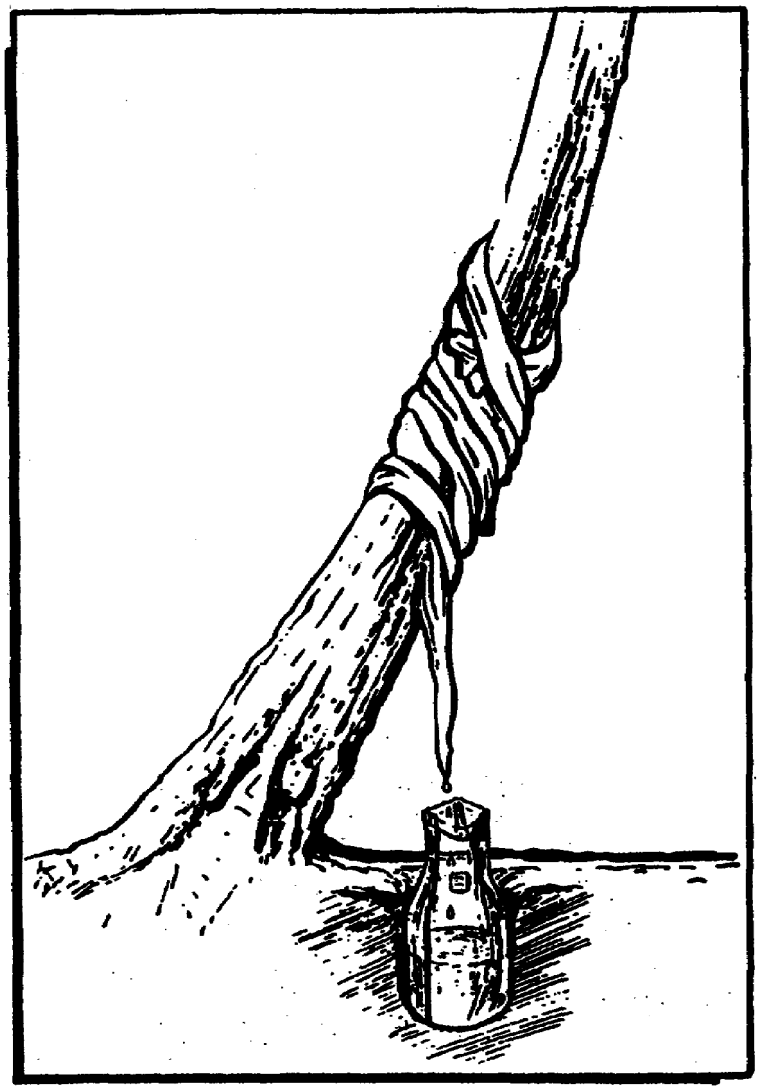


Figure 84. Collecting water from slanted tree.

18. DESERT CLIMATES

Locating and procuring water in a desert (dry) environment is a formidable task. Some of the ways to find water in this environment have been explored, such as locating a concave bend in a dry riverbed and digging for water (Figure 85). If there is any water within a few feet of the surface, the sand becomes slightly damp. Dig until water is obtained.

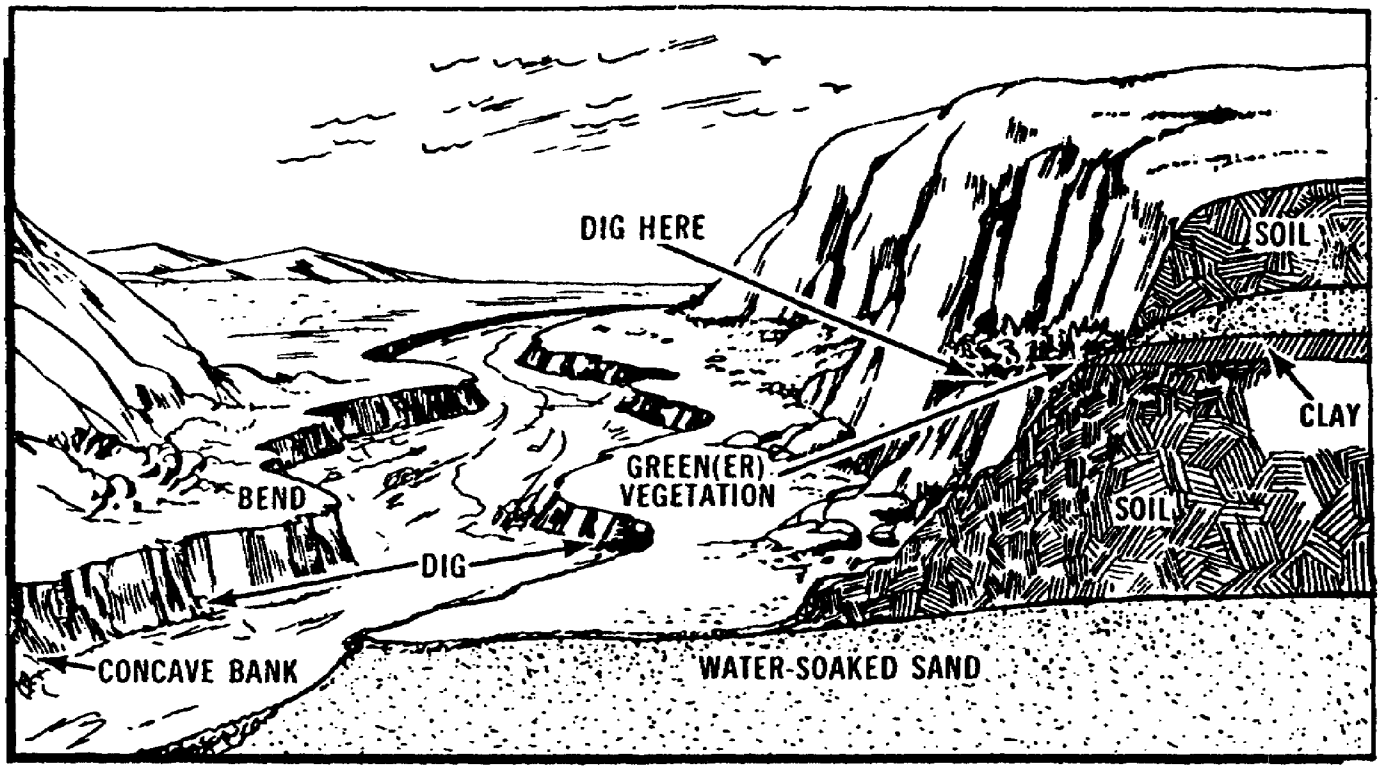


Figure 85. Dry stream bed.

a. Some deserts become humid at night. The humidity may be collected in the form of dew. Collect this dew by digging a shallow basin in the ground about 3 feet in diameter and lining it with a piece of canvas, plastic, or other suitable material. Gather stones taken from at least 1 foot below the surface. Build a pyramid with these stones in the basin. Dew collects on and between the stones and trickles down onto the lining material where it is collected and placed in a container.

b. Plants and trees having roots near the surface may be sources of water in dry areas. Water trees of dry Australia have roots that run out 40 to 80 feet at a depth of 2 to 9 inches under the surface. You obtain water from these roots by locating a root 4 to 5 feet from the trunk and cutting the root into 2-or 3-foot lengths. Then peel off the bark and drain the liquid from each section of root into a container. You can also suck out the liquid. Trees growing in hollows or depressions have the most water in their roots. Roots that are 1 to 2 inches thick are an ideal size. You can carry water in these roots by plugging one end with clay.

c. Succulent or cactus-like plants may be sources of water, but no plant that has a milky sap should be used for water. The barrel cactus of the United States provides a water source. To obtain it, first cut off the top of the plant and mash the pulpy inside portions of the plant. This forms a watery pulp. Water may ooze out and collect in the bowl; if not, squeeze the pulp through a cloth directly into your mouth.

d. The solar still uses vegetation and ground moisture to produce water (Figure 86). You can extract and collect the moisture in the soil and from plant parts (fleshy stems and leaves) from this emergency device. Obviously, where the soil is extremely dry and no fleshy plants are available, little, if any, water is obtained from the still. You can also use this still to purify polluted water (Figure 87). Steps in constructing a still are in Figure 88.

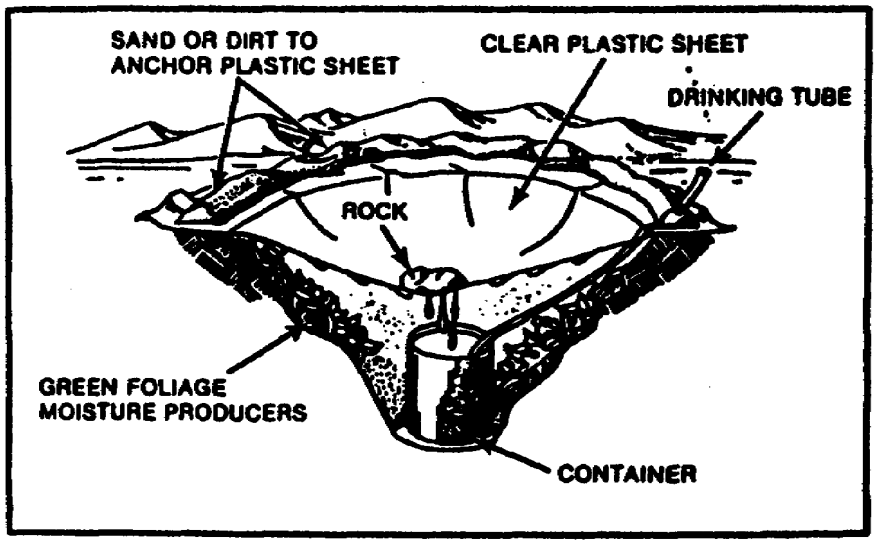


Figure 86. Solar still.

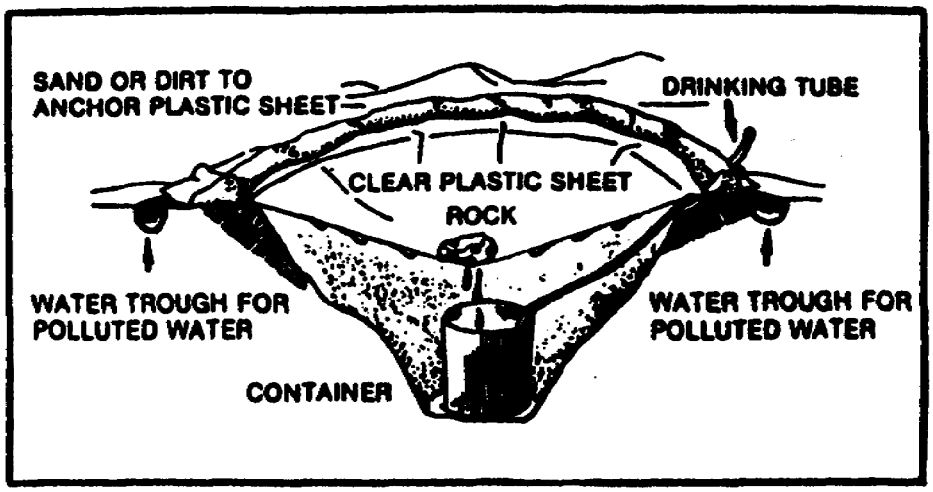


Figure 87. Below-ground still for obtaining potable water from polluted water.

STEP 1: Dig a bowl-shaped hole in the soil about 40 inches in diameter and 20 inches deep. Add a smaller, deeper sump in the center bottom of the hole to accommodate a container. Use a water collector-container or any waterproof material from which a collector-container can be fashioned. You can make a container from such materials as plastic, a poncho, aluminum foil, emergency ration tins, or a flight helmet.

a. If plant material is used, line the sides of the hole with pieces of plant or its fleshy stems and leaves.

b. If polluted waters are to be purified, dig a small trough around the side of the hole about halfway down from the top. The trough ensures that the soil wetted by the polluted water is exposed to the sunlight. At the same time, the polluted water is prevented from running into the container.

STEP 2: Obtain a piece of plastic tubing about 1/4-inch in diameter and 4 to 6 feet long, if available. The tubing is not absolutely essential but makes the still easier to use. Fasten the tubing to the bottom of the inside of the container; use the tube to remove drinking water from the container without disturbing the plastic.

STEP 3: Place a piece of plastic about 6 feet square over the hole. Some plastics work better than others, although any clear plastic should work if it is strong. Put soil on the edges to hold it in place.

STEP 4: Place a rock no larger than a plum in the center of the plastic until it is about 15 inches below ground level. The plastic now has the shape of a cone.

STEP 5: Put more soil on the plastic around the rim of the hole to hold the cone securely in place and to prevent water-vapor loss. Straighten the plastic to form a neat cone with an angle of about 30 degrees so the water drops will run down and fall into the container. It takes about one hour for the air to become saturated and start condensing on the underside of the plastic cone.

Figure 88. Constructing a solar still.

(1) If plants are available or if polluted water is to be purified, construct the still in any convenient spot where it receives direct sunlight throughout the day. The main consideration is digging ease.

If soil moisture is the only source of water, some sites are better than others. Although sand generally does not retain as much moisture as clay, wet sand works very well. Along the seacoast or in any inland area where brackish or polluted water is available, any wet soil, even sand, produces usable amounts of water. On cloudy days, the yield is reduced because direct sunlight is necessary if the still is to operate at full efficiency.

(2) Keep certain precautions in mind. If polluted water is used, make sure that none is spilled near the rim of the hole where the plastic touches the soil. Also make sure that none comes in contact with the container. This prevents the freshly distilled water from becoming contaminated. Do not disturb the plastic sheet during daylight "working hours" unless it is absolutely necessary. If a plastic drinking tube is not available, raise the plastic sheet and remove the container as few times as possible during daylight hours. It takes one-half hour for the air in the still to become resaturated and for water to begin collecting after the plastic bag has been disturbed. Even when placed on fairly damp soil and in an area where eight hours of light per day is directed on the solar still, the average yield is only about 1 cup per day per still. Because of low yields obtained from this device, you must give consideration to the possible danger of excessive dehydration brought about by constructing the solar still. In certain circumstances, what you collect from a solar still even over 2 or 3 days will not equal the amount of body fluid lost in constructing one. It actually hastens your dehydration.

e. The vegetation bag is a simpler method of procuring water. This method involves cutting foliage from trees or herbaceous plants, sealing the cuttings in a large clear plastic bag and allowing the heat of the sun to extract the fluids contained within the cuttings. Use a large, heavy-duty clear plastic bag and fill it with about 1 cubic yard of foliage. Seal it and expose it to the sun. The average yield for one bag tested was 320 milliliters per bag during a five-hour day. This method is simple to set up. The vegetation bag does have one primary drawback. The water produced is normally bitter. The biological breakdown of the leaves as they lay in the water produced and super heating in the moist "hothouse" environment cause the bitter taste. This method, can be used readily in a survival situation. However, the water produced by certain vegetation should undergo the taste test. This guards against ingesting cyanide-producing substances and other harmful toxins, such as plant alkaloids (Figure 89).

f. One more method of water procurement is the water transpiration bag. This method is simple to use and has great potential for enhancing survival. In this method the vegetation bag process is taken one step further. Place a large plastic bag over a living limb of a medium-size tree or large shrub. Seal the bag opening at the branch. Then tie the limb down to allow collected water to flow to the corner of the bag. Figure 90 depicts the water transpiration method.

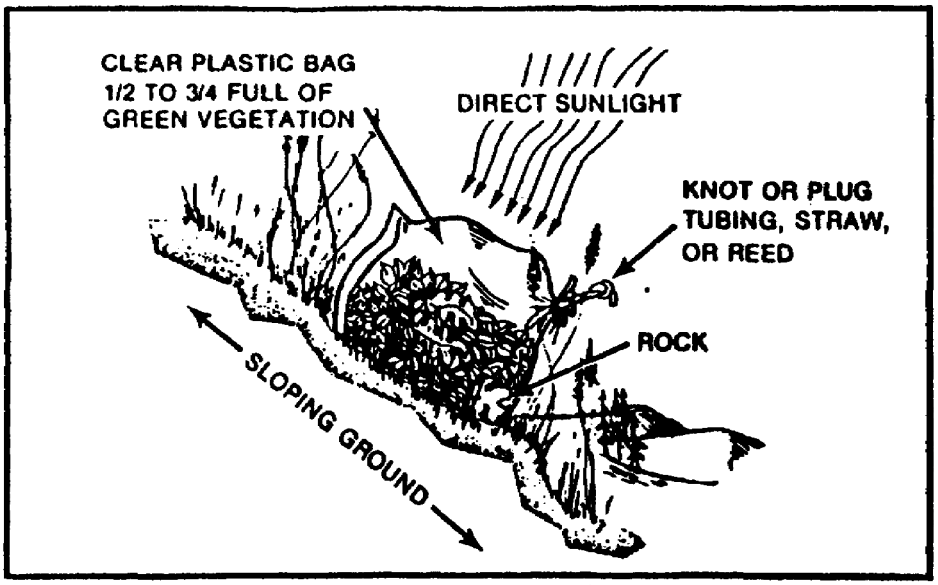


Figure 89. Moist hothouse environment.

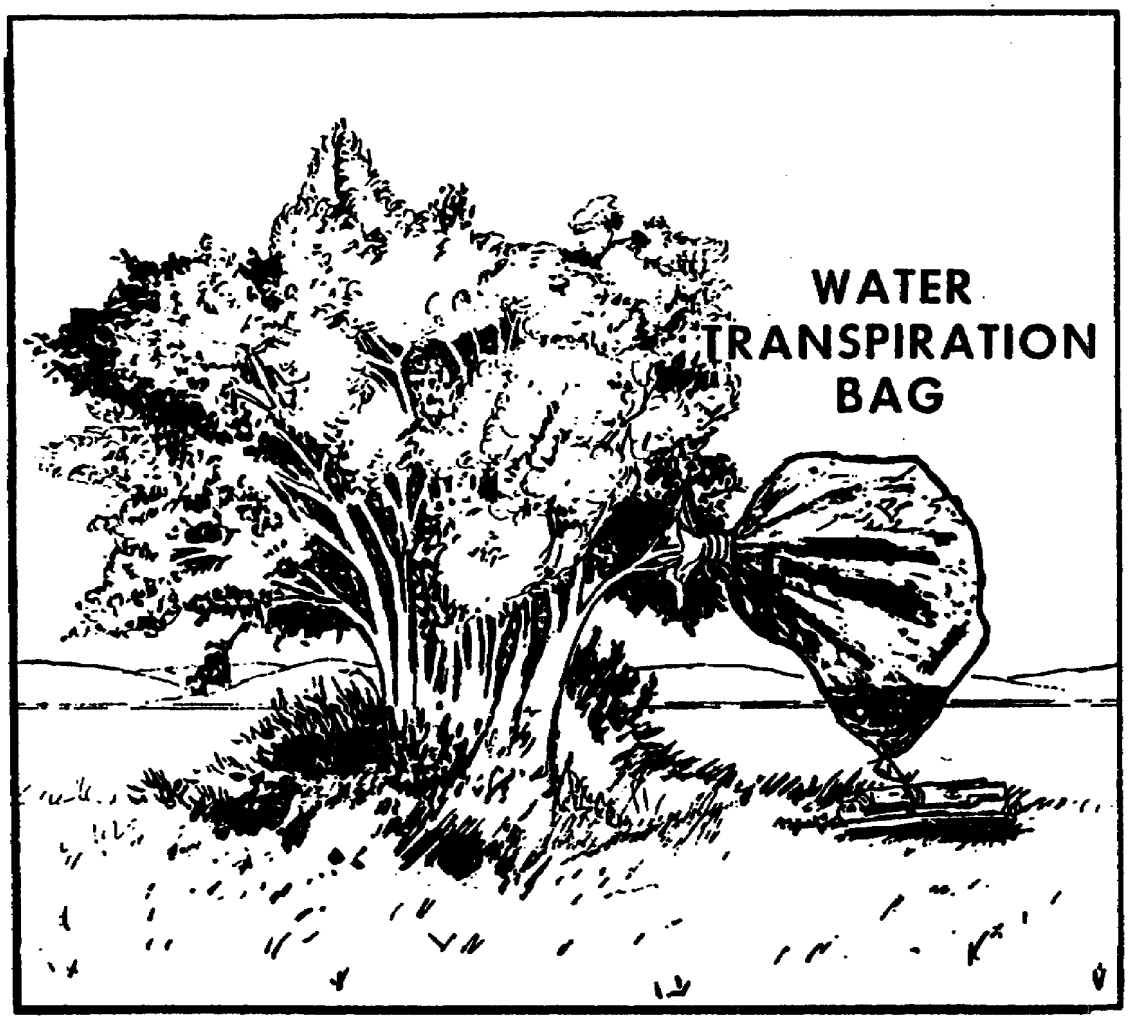


Figure 90. Transpiration bag.

(1) The amount of water yielded by this method depends on the species of trees and shrubs available. During one test of this method, a transpiration bag produced approximately 9 gallons per day for three days. The plastic bag stayed on the same limb and there was no major deterioration of the branch. Other branches yielded the same amount. Transpired water has a variety of tastes depending on whether or not the vegetation species is allowed to contact the water.

(2) The effort expended in setting up water transpiration collectors is minimal. It takes about five minutes work and requires no special skills once the method has been described or demonstrated. Collecting the water in a survival situation necessitates dismantling the plastic bag at the end of the day, draining the contents, and setting it up again the following day. The same branch may be reused (in some cases with almost similar yields); however, as a general rule, when vegetation abounds, use a new branch each day.

(3) Without a doubt, the water transpiration bag method surpasses other methods (solar stills, vegetation bag, cutting roots, barrel cactus) in yield, ease of assembly, and in most cases, taste. The benefits of having a simple plastic bag can't be over-emphasized. As a water procurer in dry, semidry, or desert environments where low woodlands predominate, it can be used as a water transpirator. In scrubland, steppes, or treeless plains, it can be used as a vegetation bag. In sandy areas without vegetation, it can be cut up and improvised into solar stills. Up to three large, heavy-duty bags may be needed to sustain one survivor in certain situations.

19. ARCTIC CLIMATES

Because arctic areas are extremely cold, water requirements are greatly increased. Increased body metabolism, inspiration of cold air, and extremely low humidity play important roles in reducing the body's water content. The processes of heat production and digestion in the body also increase the need for water in colder climates. Constructing shelters and signals and obtaining firewood are extremely demanding tasks for survivors. Because of physical exertion and heat production in extreme cold, your water requirements are close to 5 or 6 quarts per day to maintain proper hydration levels. Often your diet is dehydrated rations and high protein food sources. For the body to digest and use these food sources effectively, increased water intake is essential.

a. Obtaining water need not be a serious problem in the arctic because an abundant supply is available from streams, lakes, ponds, snow, and ice. However, you should purify all surface water by some means. In the summer, surface water may be discolored but is drinkable when purified. Water obtained from glacier-fed rivers and streams may contain high concentrations of dirt or silt. By letting the water stand for a period of time, most silt settles to the bottom; the remaining water is then strained through porous material, such as cloth, for further filtration.

b. Constructing a "water machine" produces water while you are doing other tasks. It is made by placing snow on any porous material (parachute or cotton), gathering up the edges, and suspending the bag of snow from any support near the fire. Radiant heat melts the snow, and the water drips from the lowest point on the bag. Placing a container below this point catches the water (Figure 91).

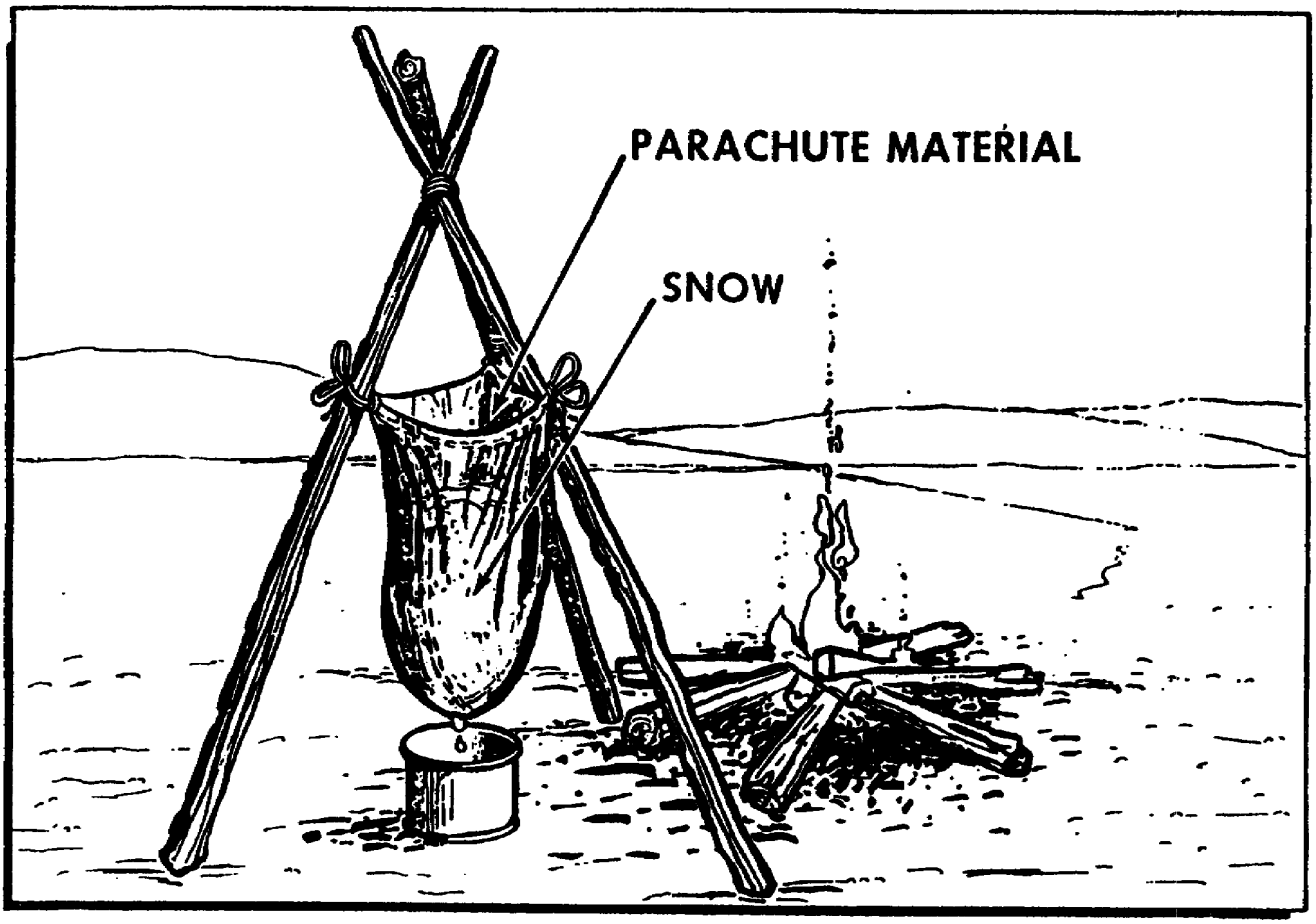


Figure 91. Water machine.

c. In some arctic areas, there may be little or no fuel to melt ice and snow for water. In this case, use body heat to do the Job. Place ice or snow in a waterproof container like a waterbag and then between clothing layers next to the body. Do not place this cold substance directly next to the skin; it causes chilling and lowers the body temperature.

d. Since icebergs are composed of freshwater, they are a readily available source of drinking water. Use extreme caution when trying to obtain water from this source. Even large icebergs can suddenly roll over and dump you into the frigid sea water. If sea ice is the primary water source, remember that, like seawater itself, saltwater ice should never be ingested. To obtain water in polar regions or sea ice areas, select old sea ice. This ice is bluish or blackish, shatters easily, generally has rounded corners, and is almost salt-free. New sea ice is milky or gray

colored with sharp edges and angles and does not shatter or break easily. Snow and ice maybe saturated with salt from blowing spray; if it tastes salty, select different snow or ice sources.

e. Ingesting unmelted snow or ice is not recommended. Eating snow or ice lowers the body's temperature, induces dehydration, and causes minor cold injury to lip and mouth membranes. Consume water in cold areas in the form of warm or hot fluids. Ingesting cold fluids or foods increases the body's need for water and requires more body heat to warm the substance.

20. ON THE OPEN SEA

Lack of drinkable water could be a major problem on the open seas. Never ingest seawater in its natural state. It causes an individual to become violently ill in a very short period of time. When water is limited and cannot be replaced by chemical or mechanical means, use it efficiently. As in the desert conserving sweat, not water, is the rule. Keep in the shade as much as possible and dampen clothing with seawater to keep cool. Do not over exert yourself, but relax and sleep as much as possible.

a. If it rains, you can collect rainwater in available containers and store it for later use. Storage containers could be cans, plastic bags, or the bladder of a life preserver. Drinking as much rainwater as possible while it is raining is advisable. If the freshwater should become contaminated with small amounts of seawater or salt spray, it remains safe for drinking (Figure 92). At night and on foggy days, you should try to collect dew for drinking water by using a sponge, chamois, handkerchief, and so forth.

Figure 92. Collecting water from a spray shield.

b. Solar stills at sea also provide a drinkable water source. Read the instructions immediately and set them up using as many stills as are available. (Be sure to attach them to the raft.) Save desalter kits, if available, for the time when no other means of procuring drinking water is available. Instructions on how to use the desalter kit are on the container.

c. Drink only water. There is no substitute for water. The so-called "water substitutes" do little for the survivor and may do more harm than drinking no water at all. Fish juices and other animal fluids have doubtful value in preventing dehydration. Fish juices contain protein, protein requires large amounts of water to be digested, and waste products must be excreted in the urine which, in turn, increases water loss. NEVER drink urine--urine is body waste material and only serves to concentrate waste materials in the body. This concentration then requires more water to eliminate the additional waste.

REVIEW EXERCISE

REQUIREMENT: Solve the following by selecting the correct answers:

1. The food group which is a very efficient energy supplier containing items such as vegetables, candy, and cereals is

   A. fats.
   B. protein.
   C. vitamins.
   D. carbohydrates.

2. What is the best hunting method for inexperienced hunters to use in a survival environment?

   A. stalk
   B. driving
   C. tracking
   D. still or stand

3. As a general rule, which color of wild berries should be avoided?

   A. blue
   B. black
   C. purple
   D. white and yellow

4. You can eat all desert wild flowers except for those with

   A. white petals.
   B. shiny petals.
   C. milky or colored sap.
   D. spiny or fleshy leaves.

5. The main point to remember when preparing insects for consumption is to

   A. cook large insects.
   B. parboil the hard parts.
   C. remove the mouth parts.
   D. eat only the hard parts.

6. After you have killed a large game animal, it might be more energy efficient to

   A. cook the animal whole.
   B. move the camp to the meat.
   C. pack the meat to the camp.
   D. take only what you need back to camp.

7. All parts of animals in the arctic regions are edible except

A. the kidney and heart of seals.
B. any organ of a seal or polar bear.
C. the liver of seals and polar bears.
D. the heart of seals and polar bears.

8. When preparing meat under survival conditions, all fat should be

A. discarded.
B. eaten only as a last resort.
C. saved so that it can be eaten.
D. converted to lard for cooking.

9. The primary reason to cook food in a survival situation is to

A. improve the food taste.
B. kill internal parasites.
C. make the food easier to chew.
D. improve the nutritional value.

10. What is the safest, simplest, and the most nutritious method of cooking food?

A. baking
B. boiling
C. roasting
D. steaming

11. The cooking method that exposes food to direct heat and quickly destroys nutritional value is

A. baking.
B. frying.
C. boiling.
D. roasting.

12. The amount of water that can be obtained from a land solar still is directly proportional to the

A. ph content of the soil.
B. elevation above sea level.
C. moisture content of the soil.
D. ambient temperature and rainfall.

13. Which water collection method surpasses all others in yield, ease of assembly, and taste?

A. solar still
B. cutting roots
C. vegetation bag
D. transpiration bag

14. How many minutes should water be boiled to make it safe for drinking?

A. two
B. three
C. five
D. ten

REVIEW EXERCISE SOLUTIONS

1. D. (paragraph 2a(1))
2. D. (paragraph 4b(1)(a))
3. D. (paragraph 10b(2)(e))
4. C. (paragraph 10b(2)(f))
5. A. (paragraph 9)
6. B. (paragraph 12f)
7. C. (paragraph 7c)
8. C. (paragraph 12e)
9. B. (paragraph 12g and 9)
10. B. (paragraph 12g(1))
11. D. (paragraph 12g(3))
12. C. (paragraph 18d)
13. D. (paragraph 18f(1))
14. D. (paragraph 16c)